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The introduction of managed care and capitated budgets in military hospitals presents a new focus on the "bottom-line" with an emphasis on cost control and management. Over the last two decades, military hospitals have used a system that produces "full cost" data. Obtaining and using "full costs" are necessary when businesses set price(or charges); however military hospitals are not for-profit entities, nor are they equipped to capture patient-level charges or resource use for billing purposes.



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GRADUATE PROGRAM IN HEALTH CARE ADMINISTRATION

# A DIFFERENTIAL COST STUDY OF CARDIOTHORACIC SURGERY AT WILFORD HALL MEDICAL CENTER

A GRADUATE MANAGEMENT PROJECT SUBMITTED TO

THE FACULTY OF BAYLOR UNIVERSITY

IN PARTIAL FULFILLMENT OF THE

DEGREE OF MHA FOR THE

GRADUATE PROGRAM IN HEALTH CARE ADMINISTRATION

BY

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FORT SAM HOUSTON, TEXAS

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# ABSTRACT

The introduction of managed care and capitated budgets in military hospitals presents a new focus on the "bottom-line" with an emphasis on cost control and management. Over the last two decades, military hospitals have used a system that produces "full cost" data. Obtaining and using "full costs" are necessary when businesses set prices (or charges); however, military hospitals are not for-profit entities, nor are they equipped to capture patient-level charges or resource use for billing purposes. Such a sophisticated charge-capture system would better equip military hospitals to estimate differential costs which are more useful than full costs for making many business decisions. A differential cost is the difference in costs between two or more alternatives (such as make/buy decisions). Although potentially misleading, estimating differential costs in military hospitals using full cost data is better than having no data at all.

This study examined the processes and difficulties in using a simple spreadsheet model on existing data of a "full cost" system to estimate, over the short-run (less than 5 years), the relevant, differential cost of adding/deleting individual patients in the Cardiothoracic Surgery (CT) product line of diagnosis related groups (DRGs) at Wilford Hall Medical Center (WHMC). Product lines, as suggested by Cleverley (1987) are an amalgamation of patients in a manner that makes sense. As such, CT's product line includes both inpatient and outpatient products. The products of interest in this study are inpatient products (DRGs).

Based on this study's conclusions, processes and difficulties were encountered in using a simple spreadsheet model of existing data to estimate the differential cost of adding/deleting individual patients in a DRG serviced by the CT department at WHMC. Navigating through these processes was a time-consuming task, yet was a cost-beneficial endeavor. Using this study's conceptual model to estimate differential costs was clearly justified in cost savings given the information costs in doing so.

The results of this study revealed the cost behaviors of CT; and, armed with this information, attention may focus on the cost drivers that account for CT's resource consumption. Also with the introduction of capitated budgets, interest may focus on the need for better costing systems--to both monitor and control patient costs. This analysis tool does not serve as a patient-level cost accounting alternative; however, it will provide health care managers at WHMC assistance in implementing new strategic directions, such as make/buy decisions. Answering questions like, "Would we be better off with a contract than without one?" may now be answered using estimated differential costs rather than full costs.

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CHAPTER I

# INTRODUCTION

## Background

The introduction of managed care and capitated budgets in military hospitals presents a new focus on the "bottom-line" with an emphasis on cost control and management. Over the last two decades, military hospitals have used a system that produces "full cost" data. Obtaining and using "full costs" are necessary when businesses set prices (or charges); however, military hospitals are not for-profit entities, nor are they equipped to capture patient-level charges or resource use for billing purposes. Such a sophisticated charge-capture system would better equip military hospitals to estimate differential costs which are more useful than full costs for making many business decisions.

A differential cost is the difference in costs between two or more alternatives (such as make/buy decisions). Although potentially misleading, estimating differential costs in military hospitals using full cost data is better than having no data at all. Since not all costs are equally important in decision making, it becomes necessary to identify relevant costs. Relevant costs are those costs that are affected (or vary) with the decision at hand such as whether to make/buy, add/drop, or increase/decrease services. A relevant cost is defined by Garrison (1991) as a "cost that is applicable to a particular decision" and these costs may be applied towards decision alternatives.

This study examined the processes and difficulties in using a simple spreadsheet model on existing data, generally from a "full cost" reporting system, to estimate, over the short-run (less than 5 years), the relevant, differential cost of adding/deleting individual patients in the Cardiothoracic Surgery (CT) product line of diagnosis related groups (DRGs) at Wilford Hall Medical Center (WHMC). Product lines, as suggested by Cleverley (1987) are an amalgamation of patients in a manner that makes sense. As such, CT's product line included both inpatient and outpatient products. The products of interest in this study were inpatient products (DRGs). Outpatient products (number of visits, etc.) were not incorporated in this study since CT services were predominantly rendered in the inpatient setting.

Conditions Which Prompted The Study

A recent cost analysis at WHMC of DRG 106 (coronary bypass with cardiac catheterization), using "full cost" data from the Medical Expense and Performance Reporting System (MEPRS), showed an average patient in DRG 106 cost WHMC $32,078 per case and reported DRG 106 was the highest (total) costing DRG performed at WHMC ($5.9 million, FY93). This finding, along with work already underway to determine patient-level costs and establish a critical pathway protocol for DRG 106, provided the impetus to estimate the differential cost of adding/deleting individual CT patients by DRG. Likewise, such differential cost information would be useful for making other business decisions.

The CT Surgery department staff raised concerns regarding the MEPRS-derived cost of DRG 106 and the use of this cost data for business decisions. Their specific concerns were: 1) the validity and reliability of MEPRS data; and 2) the volume-related allocation method used by MEPRS to "cost out" individual DRGs. For instance, consider the method by which the operating room "costs" were assigned to CT. Total monthly expenses and operating minutes were determined for the entire operating room and a percentage of workload (minutes) consumed by CT was determined. CT was allocated this percentage of the operating room's expenses and an average expense per minute was calculated.

With this methodology, any procedure requiring 60 minutes was considered twice as expensive as a 30-minute procedure. Such a method ignored the fact that there may be short procedures requiring expensive, sophisticated equipment and long procedures that used less costly resources. Essentially, MEPRS took the total spending on resources and divided by the actual output and by doing so, caused the unit cost of product output to fluctuate significantly, period by period, depending on volume fluctuations. Based on CT's concerns, some MEPRS workload and cost data obtained for CT was to be further explored and improved upon if possible.

By performing a differential cost study of CT's activities, WHMC would have a simple, flexible spreadsheet model that may be applied to more that one cost objective. By providing this cost information, CT would gain a fuller understanding of the differential costs that were useful for decision making such as choosing whether to "contract out" or disengage Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) patients (active duty dependents/retirees) while keeping CT open for

other patients (DRGs). Equipped with relevant, differential cost information, CT as well as other departments could compare the costs of alternatives in making business decisions.

However, the best costing of CT services would require direct continuous observation of each patient and the capture of actual resources consumed. Understandably, no military treatment facility (MTF) could afford the information cost of such continuous monitoring. Since MEPRS data were both free and often the best data currently available, MEPRS values were used unless they could be replaced with more accurate data that were simple and inexpensive to collect.

## Statement of the Problem

What were the processes and difficulties in using a simple spreadsheet model on existing data to estimate the differential cost of adding/deleting patients in DRGs serviced by the CT department at Wilford Hall Medical Center?

## Literature Review

There is an abundance of literature available addressing the applicability of incremental (or differential) costs for decision making both in general business and in the health care setting (Suver and Neumann 1981, Finkler 1994). The recent attention directed at the shortcomings of traditional cost accounting systems (Finkler 1991, Turney 1991) also stimulated a wealth of articles on improvements resulting in better product costing. This review will begin with an introduction of cost accounting (Belkaoui 1991), discussing its value to the health care organization (Suver 1981). Then cost measurement will be covered along with the concepts of full cost, average cost, cost objects, direct and indirect costs, fixed, variable, marginal, total and joint costs with respect to departmental and product costing (Suver 1981). Current accounting literature emphasizes that there is not one "true" cost that can be measured (Finkler 1990). Instead, different measures of cost are appropriate for different needs.

Additionally, different applicable approaches to grouping health care costs for this review will be discussed such as job order and process costing to determine the unit cost of products (Cleverley 1987). Traditional cost allocation will be addressed as applicable to this review along with the concerns about it

(Young 1985), namely the accuracy of the step-down allocation technique (Weisman 1991). Proper allocation of cost pools and cost drivers will also be included (Belkaoui 1991). Finally, the issue of developing cost information for alternative care decisions and relevant costs is discussed, while addressing alternative cost accounting techniques like procedure level costing and activity-based costing and their limitations (Antos 1992, Chan 1993, Cooper 1990, Finkler 1991, Garrison 1991, Glennie et al. 1994, Kaplan 1990, Roth 1991, Woods 1992).

1. Introduction of Cost Accounting

A brief introduction to cost accounting concepts is necessary before discussing the process of hospital cost accounting. In theory, cost accounting is nothing more than identifying resources consumed in the production/provision of goods and services and the corresponding costs of those resources (Finkler 1994). Practical application of this theory requires an understanding of the facets to a cost accounting system. Horngren (1972) says a cost accounting system must at least: 1) identify the cost objects; 2) identify the costs that can be traced directly to those objects; 3) determine the pools for collection of other (indirect) costs and identify which costs should be allowed into each cost pool; and 4) determine the basis to allocate or apportion the costs of each pool to the cost objects.

A "cost object" is any activity or item to be costed (Horngren 1972). Traditional cost accounting systems capture costs and aggregate them into cost pools. Cost pools may be thought of as function-oriented such as "getting an x-ray." Cost pools have boundaries in time and (organizational) behavior, with the pool logic being homogenous with respect to the cost object (and cost driver). A cost pool may be broad and span into other cost centers or be a subset of one.

Once aggregated into cost pools, allocation occurs. While the best bases would be causative, accountants may settle for bases that are "equitable," with zero correlation to a fixed cost. Cost allocation is a mechanism used to account for all costs associated with a business entity, usually at the product level (Weisman 1991). Allocated costs are then divided up among the various departments, products and services on some arbitrary basis, usually by relative use. Cost allocation systems tend to be based on cost recovery and take costs that are already sunk (historical) and treat them as costs of current products or departments.

When addressing cost accounting in health care organizations, it is important to review its uses. Until the advent of prospective payment system (PPS) in 1983, hospitals received payment for services based on their cost (Finkler 1994). Since 1983, hospitals receive most revenues or payments as fixed per discrete episode of care on the basis of DRG, per diem or discharge. An emphasis on controlling and understanding costs evolved, and provided the impetus to develop cost accounting systems with detailed clinical and financial data. This data would be used for a variety of purposes such as cost management at a department level, pricing decisions with Health Maintenance Organizations (HMOs), strategic planning, physician management and profitability analysis. Today, managing the bottom line with cost control and management is critical to survival (Chan 1993).

2. Cost Measurement

Traditional cost accounting measures costs according to the organization's department structure and allocates overhead to products rather arbitrarily, usually based on labor hours or direct costs. The arbitrariness results from a poor understanding of the true determinants of costs assigned to products and services, which are likely to be statistically invalid (Belkaoui 1991). Despite these limitations, cost allocation serves a variety of needs for internal reporting and for aiding in decision making.

The type of information that is useful in the health care business has changed. Cost accounting has evolved into an internal product for management's decision-making; consequently, cost accounting systems in place today permit management to improve certain decisions such as cost-per-unit for pricing or profitability decisions. Businesses that require accurate reporting of financial information tend to create accounting systems whose primary function of cost measurement are to ensure accountability of all (full) costs (Weisman 1991). However, business decisions made on the basis of full costs may satisfy reporting requirements; yet, cost allocations serve only to cloud the true cost/benefit trade-off that form the basis for a business decision.

3. Direct and Indirect Costs

The basic elements of cost are materials, labor and administrative services (typically called overhead or support costs) (Suver 1981). These elements are usually expressed as either direct or indirect costs.

Suver defines full costs as the measured direct costs of providing a service plus some share of any indirect costs incurred by the hospital.

Direct costs are those costs which can be specifically traced to or identified with a specific procedure or service such as the salary and fringe benefits of the professional and support personnel who contribute directly to providing a service or the monitoring of the equipment in an intensive care unit. One major criterion in deciding whether an item is a direct cost or not is whether the cost would be eliminated, at least in the long run, if the service were no longer provided. Direct costs are usually the easiest to control because they occur at the department level.

Indirect costs are those costs which cannot be specifically traced to an individual service or procedure. Indirect costs may also be costs that would be direct except that it is too costly to measure the amount used by each cost object (like electricity). Most indirect costs will continue even if the particular service is no longer provided. Indirect costs are any costs that cannot be classified as a direct cost for any individual department or product. Some examples include office supplies and equipment, rent, and most management costs. Overhead costs include the indirect administrative costs of patient care department and other administrative and support services of the hospital such as information services, maintenance and housekeeping (which may account for more than 35% of total practice overhead) (Glennie 1994).

4. Fixed and Variable Costs

The determination of what is a direct or indirect cost depends on what cost objective is being evaluated. For instance, administration costs are direct costs at the hospital level, yet are considered indirect at the clinical department level. Likewise, almost all costs are considered direct for the hospital; yet, for the individual product there are far fewer direct costs and many more indirect costs.

Costs also can be characterized by how they react to changes in volume. Generally, costs can be divided into two categories--fixed and variable. Variable costs are those costs which vary directly and proportionately with volume. Many direct costs, such as clinical supplies, are examples of pure variable costs since they increase in proportion to the number of services performed. Conversely, fixed costs are those costs that do not vary with volume. Most indirect costs, such as rental costs, are fixed costs. Professional staff salaries are a good example of fixed costs if their salary does not increase with the

number of services provided. Direct and variable characterizations are not synonymous. Direct costs are those that can be traced to a single cost object (such as a procedure). Variable costs are costs that vary with the change in volume of procedures. Most variable costs are also direct costs, but not all direct costs are variable and some indirect costs may be variable (electricity).

Managers can make better decisions at each level of an organization if fixed and variable costs are known (Woods 1992). Separate reporting of fixed and variable costs facilitates differential cost analysis and decision making. With differential cost accounting, all costs are subject to change with each particular decision (Suver 1981). The determination of the variable cost component can be accomplished several ways. The most obvious is direct inspection of the process, such as determining the portion of costs that are variable (lab tests, x-rays, etc.) versus those which are entirely fixed (such as administrative salaries). The most difficult task is estimating the costs that have both a fixed and variable component. Although statistical methods may be used (regression); they require more data than may be available. As an alternative, an interview with the responsible person for the activity may suffice by offering some guidance--when estimating the variable component relative to the levels of volume, only the variable costs should change.

5. Short-Run vs. Long-Run

Costs may have a short-run or long-run orientation (Weisman 1991). It is important to consider the time factor involved with decisions; however, confusion occurs when managers assume that costs become sunk (or unavoidable) as a function of time, rather than due to the particular business decision at hand. Time is merely a function to establish when a past business decision was made so the manager can classify costs as either avoidable or unavoidable. If the decision is one that is expected to come up for review at frequent short-run intervals, an analysis of short-run costs may be adequate. Decisions spanning the short-run will find that some costs be avoided while many others are committed in advance and cannot be avoided.

Conversely, decisions spanning the long-run ignore most past decisions and considers all these costs avoidable and relevant. Business decisions in the short-run require discerning between which costs are avoidable and which are not. For example, suppose a hospital decides to provide a service that requires 10

beds, and at the moment there are excess beds. In the short run, the extra cost of the service will include the staffing, but not the construction of space for the 10 beds. In the long run, new bed space will have to be built if the hospital's overall volume of services is growing. So the long-run cost of the considered product would have to include the entire cost of building the beds, because if the optional program were not offered, 10 fewer beds would have had to be constructed.

6. Relevant Costs

When making a decision involving choices among various alternative courses of action, a decision model is useful. The decision model used in this study follows the concept of differential analysis using incremental, relevant costs. Costs may be either relevant or irrelevant for decision making purposes and incremental costs are always relevant to managerial decisions affecting volume. Garrison (1991) simplifies deciding which costs are relevant by considering all costs to be avoidable, except sunk costs and future costs that do not differ between the alternatives being assessed.

Woods (1992) explains that different decisions require different relevant cost information. For nonroutine decisions in hospitals, the decision maker must know how to recognize which costs are relevant and which are not (Garrison 1991). Using irrelevant costs with relevant costs may cloud the picture and draw attention away from the relevant matters. At worst, an irrelevant piece of information may result in an incorrect decision.

The relevancy of costs depends on the identification of costs. Belkaoui's (1991) concept of relevancy depends on the identification of costs as: 1) sunk vs. out-of-pocket; 2) marginal, incremental , or differential costs; 3) historical vs. opportunity; and 4) escapable vs. inescapable.

Sunk costs are past expenditures that have already been incurred and cannot be avoided regardless if changed by future or present events (Belkaoui 1991). For example, assuming capacity exists, funding already spent on a bypass pump is a sunk cost for the purpose of deciding whether to add heart transplant services to CT, unless the bypass pump wears out more quickly due to higher usage. Joint costs (those that cannot be separated by usage) and common costs (those shared by all variables under consideration) are ignored, as they are also sunk costs (those associated with the original investment). As such, by failing to distinguish between sunk (i.e., unavoidable) and avoidable costs, managers may make faulty

business decisions (Weisman 1991). Costs that are already sunk and cannot be avoided only cloud and distort business decisions.

Incremental or differential costs are the expected future costs that differ as a result of choosing one alternative over another (Belkaoui 1991). The change in costs resulting from a change in operating level is an incremental cost. Belkaoui identifies marginal cost as a unit concept; it refers to the cost created by the production of one additional unit. In other words, if Y1 and Y2 are costs associated with alternatives 1 and 2, and X1 and X2 are the output levels for the same alternative, then Y2-Y1= incremental costs and

$\frac{Y2-Y1}{X2-X1}$=marginal costs (per unit of output changed).

Opportunity costs refer to the benefits lost (or incremental revenues foregone) by choosing one alternative over another (Belkaoui 1991). With limited resources, any decision to produce a given commodity implies doing without some other commodity.

An escapable cost can be incurred by a structural or operational change. For example, if the cost of labor is reduced by a curtailment of services such a cost may be considered an escapable or avoidable cost. Inescapable or unavoidable costs must be incurred despite structural or operational changes. In general, the out-of-pocket, incremental, marginal, opportunity and escapable costs are relevant for decision making.

7. Differential Costs

Differential cost analysis is similar to the economists use of marginal analysis except that the accounting view is interested in the additional cost of a change in the level of production rather than the cost of an additional unit (Belkaoui 1991). Differential costs are the relevant costs for decision making. Differential costs may include variable costs and fixed costs. Variable costs are differential costs when the decision involves a change in volume. Fixed costs may be differential in the long run when changes in capacity are involved. They may be differential in the short run too. Beware of hasty conclusions that all variable costs are relevant and all fixed costs are irrelevant. Relevant or differential costs are those costs (variable or fixed) that are expected to differ the choice between alternative actions.

For example, when deciding whether to buy an ambulance, the purchase price and operating costs of the ambulance are differential and relevant costs. After buying it, the operating costs are still relevant costs, but the original purchase price is not. The original purchase price or historical cost is sunk and therefore irrelevant to decision-making. Historical costs of an asset may be considered relevant given that they will have an impact on taxes through gains/losses on disposition or through taxes saved through depreciation.

In make/buy decisions, management should evaluate the qualitative and quantitative factors important to the decision. One qualitative factor supporting a "buy" decision would be problems with availability of knowledge, technology, skilled labor, or materials. A factor supporting a "make" decision would be the desire to secure and maintain high quality parts. Quantitative factors involve comparing the cost of making/providing a service with the cost (or price) of buying (contracting) it.

For example, assume a Health Maintenance Organization (HMO) offers to provide heart transplant services at WHMC. What should the health care manager decide? More information is needed on the nature of the costs. The manager can determine whether some of the costs are unavoidable; i.e., whether they will continue to be incurred regardless of the decision. The manager must also investigate how to best use the idle capacity resulting from a buy decision. Essentially, the decision to make or buy becomes a decision of how to use the available facilities. More explicitly, management must determine the opportunity costs of resources that will be expended as a result of the decision to buy rather than make the product.

Assume that adding heart transplant services at WHMC will involve an increment in professional labor of one surgeon indefinitely, an increment purchase of one heart-lung pump indefinitely, and an increment of 100 units of blood per month. If the health care manager has the current unit costs of each of these resources at the volume of procedures anticipated both with and without the increments in question, the question of "what difference will it make" becomes answerable.

The incremental labor cost for CT surgery physicians, for instance, is contained in a continuous process operation that has operating capability around the clock seven days a week. The number of surgeries performed fluctuates based on the demand for service (scheduled and emergencies) and does not

normally entail a change in the manning levels for CT surgeons. CT surgeons are attached to CT and the usage of their labor remains constant as output varies. This means that there is a surplus of CT surgeon labor services when the demand for services is below the maximum. The incremental cost of adding heart transplant services to WHMC is then limited to possibly other materials, equipment, labor costs, etc. The incentive is to match patient (demand) capacity to CT surgery capacity; however, if adding heart transplant services results in raising the volume of services to 110% of the capacity of CT surgeons, then labor costs for an additional surgeon (part-time) will need to be included. The general idea is to recognize that incremental unit costs vary with volume and be prepared to provide and use the cost that is relevant to the circumstances of the specific case rather than insisting that the unit cost is either a full average cost or a variable cost premised on idle capacity.

8. Grouping Health Care Costs

Full costing is just one approach to grouping health care costs. Other applicable approaches include job order costing and process costing to determine the unit cost of a product. Job order costing and process costing differ and are each appropriate in certain circumstances.

Job order costing is an approach most appropriate to implement when products are discontinuous and unequal (discrete). All costs are traced to "jobs;" and average costing only occurs within the job. Since indirect costs require averaging, in job order costing, overhead costs need to be defined and estimated. An apportioning basis needs to be selected and estimated to calculate a predetermined rate. This rate is then applied to units periodically, at job completion. In job order costing, overhead is not considered in the product cost until the job is finished.

Process costing is an approach most appropriate when products are continuous or equal. All costs are traceable to work centers (departments); and average costing occurs only within the department. Process costing uses a weighted average method to determine the unit cost of a product.

Cleverley's (1987) literature on product costing offers a technique for product costing specifically in the health care industry. He distinguishes between products and product lines and suggests that the patient is the basic product of a health care firm. The services provided are the intermediate products and not the final product. He uses the term Service Unit (SU) to define the product of a department or

business unit. Standard Cost Profiles feature specifications of what constitutes a SU and the profile of resources required to produce the SU. SUs may include direct or indirect costs and variable and fixed costs. Allocation of costs is performed by either empirical studies or allocation by mathematical means-cost averaging. Standard Treatment Protocols may be considered analogous to a job order where actual costs of SUs are assigned to patients. Indirect SUs will be allocated to the direct SUs. The objective is to create as many direct SUs as possible.

9. Traditional Cost Accounting

As Weisman (1991) stated, " business decisions can be no better than the information on which they are based." The traditional cost accounting system is incapable of providing managers with the cost information they need to make good business decisions; it gives health care managers reports of where costs are spent yet no indication of what is creating the costs (O'Guin 1991). Weisman suggests an organization should follow two fundamental principles when developing a costing system: 1) Cost causality-- the only costs that are relevant for a given business decision are those costs that are caused by making that decision; and 2) Cost dynamics--costs do not become sunk or unavoidable as a function of time, but rather a function of business decisions--each of which has a specific time horizon associated with it.

The inadequacies of existing cost accounting systems is a recent focus in business literature. The concern is that costing has evolved primarily into a tool for external reporting of financial results, rather than for the management of the organization (Finkler 1994). Failures with the traditional cost accounting methodology include the inability to report product costs to a reasonable level of accuracy (Cooper 1990).

10. Activity-Based Costing (ABC)

One new technique that has received a great deal of attention is the activity-based costing (ABC) system, developed some 10 years ago to support manufacturing processes where the focus of the cost accounting is activities, not products. Peter Drucker (1993) laments that one of the reasons costs of hospitals are out of control is that we do not know how spending relates to the work the service organization does and to its results. Drucker calls for new measurements to provide business control in

the service industry. Although ABC has had a limited application in the service sector, he credits ABC as a step in the right direction in "moving from counting to measuring."

Attention has focused on ABC systems because they provide three major benefits: 1) more accurate product costs; 2) improved understanding of the economics of production; and 3) a portrayal of the economics of activities performed by a business (Cooper 1990). ABC systems measure the cost of producing a product. These systems more accurately assign the indirect and support expenses of the organization's resources to the products that either create the demands for or benefit from these resources (Kaplan 1990).

Companies that have adopted ABC have treated their ABC system as a management information system that coexists with their accounting system, rather than replaces it (Woods 1992). Success stories of companies using ABC say it tracks cost-saving efforts and encourages better use of resources (Drumheller 1993). ABC is credited with helping businesses obtain better pricing, budgeting and forecasting information.

Two assumptions underlie ABC: 1) The costs in each cost pool are driven by homogenous activities; and 2) The costs in each cost pool are strictly proportional to the activity (Roth 1991). When either of these assumptions is violated, ABC may not produce better cost data than traditional volume-based costing. The first assumption, homogeneity, means that the costs in each pool are driven by a single activity or by highly correlated activities. Highly correlated means that changes in the level of one activity are accompanied by proportional changes in the other activities. If homogeneity is violated, when only one of the activities is used to assign all costs in the cost pool to products, some costs are assigned to products on an arbitrary basis. The arbitrarily assigned costs are those caused by an activity that was not used as the cost driver.

The second assumption, proportionality, means that all costs in the cost pool should vary proportionally with changes in the activity level. Nonlinear costs will violate this assumption (such as the learning curve phenomenon), or if both fixed and variable costs are included in the same cost pool and they are assigned to products as if they were strictly variable. And finally, joint costs will violate this assumption when they are not strictly proportional to the activity.

## 11. ABC Limitations in Health Care

A natural question is why ABC is so slow to be implemented in the health care setting since its reputed to be successful in application in the manufacturing sector. Antos (1992) believes the broader concept of activity-based management (or ABM) is applicable to service companies, not-for-profit institutions and governmental entities. Plausible reasons for why ABC is not readily adopted in the health care setting include: 1) products are harder to define and measure; 2) processes and their costs are more complex, and less readily bound to easily-counted activities; 3) intermediate products exist in many settings, adding another layer of analysis for each product and adding to the time and cost of implementation; 4) the historical cost-based reimbursement payment methods of health care have insulated it from the competitive marketplace, postponing the recognition of the need for accurate unit cost information and control (Orloff 1990). Also, the technical feasibility of implementing ABC must be evaluated since it is time-intensive to identify the activities that consume resources, accumulate costs per activity and to select appropriate cost drivers for cost application (Chan 1993).

Cost driver information that is required by ABC systems translates to substantial efforts in data collection and measurement. Consequently, Chan explains that ABC systems should be implemented in organizations where competition is severe since the cost of errors with a conventional costing system is high. Chan believes that combining ABC with critical pathways per DRG is necessary to identify unprofitable treatments, the costs of which may be greater than the fixed payments from the third party payor. She says that once costly treatments are identified, actions can be taken to either reduce or eliminate the nonessential activities of the treatments. Another idea she offers is to change the mix of services provided, reducing the costly services where possible.

Any cost accounting system will be of little value if physician input is missing (Finkler 1994). A cost accounting system should provide information to review physician efficiency through a comparison of different physicians' treatment protocols for varying types of patients. Ideally, if the system can provide profitability analysis about physicians' clinical practice patterns, management can alter physician behavior based upon what the system has determined it can afford to pay (Finkler 1994). In a competitive environment it is critical for health care managers to understand the production function and to work with

physicians to improve the quality of services provided while at the same time providing those services in a more cost effective and efficient manner.

## Purpose

To restate the problem statement: how could we estimate the differential costs of adding/deleting individual patients for a CT DRG within the limitations of the information (inputs) available at WHMC? Differential costs would be useful for choosing whether to "contract out" or disengage to CHAMPUS some patients while keeping CT open for others.

The focus of this study was to show a method existed to determine differential cost information. Despite the limitations of existing data, WHMC could refine the data included as inputs to come closer to knowing the precise amount of relevant costs associated with each DRG. The possibility also existed to apply this model to more than one cost objective.

The method used in this study might benefit other MTFs that want to gain a fuller understanding of differential costs useful in decision making. WHMC and/or any MTF have a tool available to examine the costs incurred by patients (DRGs, etc.), analyze the cost behavior of individual departments, and implement strategies to contain costs.

# CHAPTER II

# METHOD AND PROCEDURES

The method to identify and document the processes and difficulties in estimating differential costs began with a search for reliable, existing data. Beginning with MEPRS, workload and "cost" data were collected for each service contributing to CT's costs. Following a review of MEPRS data, the "feeder" systems; i.e., the Pharmacy system, the Radiology system, etc., that relayed data to MEPRS also required evaluation. Since the data collected in this study were primarily prospectively collected, the day-to-day collection of data was possible and permitted a validation check against the MEPRS data. Consequently, this check resulted in the decision to seek improved data for use in the software model--an arduous task of collecting and recording patient-level data.

The MEPRS captured manpower, expenses, and workload in its MEPRS Version III Expense Analysis Report and summarized each functional area's monthly activity. MEPRS (and the data collection systems supplying MEPRS) is the current mechanism used to capture "costs" in military hospitals. Consequently, this study was limited to a MEPRS-approach to obtain costs.

The data gathered for this study were comprised of all CT patients receiving surgery between September 1-30, 1994. This time frame was selected based on two reasons: 1) availability of FY 1994 CHAMPUS data, and 2) being able to prospectively identify data to collect.

To estimate differential costs from a traditional cost accounting system required eight steps, the completion of which produced a "rough" unit incremental cost (Holmes 1995).

1. Identify all relevant costs.
2. Extract only those costs that at least partially support CT (inpatient only), and set aside those that are not relevant or affected by changes in volume or availability of services.
3. Cluster services into functional products (by DRG) for counting and costing in the spreadsheet model.
4. Identify the bases (cost drivers) which most accurately estimate causation of costs for each type of cost. (These are the individual characteristics that drive a costly CT function.)
5. Count the activities or cost drivers for each DRG.
6. Estimate the costs resulting from CT for each of the types of costs.
7. Total the costs for all CT functions to determine the incremental cost of one unit, for each DRG.
8. Compare the incremental cost for each DRG to the CHAMPUS claims paid costs.

Each of the first seven steps, as proposed here, will be described in the paragraphs that follow.

<u>Step 1: Identify all relevant costs.</u>

Relevant costs occurred at three levels to the service (CT): external, departmental and direct. External level costs were the least traceable of the three levels and were allocated to the service from other cost centers of the facility such as administration and health promotions. For CT, external costs appeared on the MEPRS Step-down Analysis report supplied by the WHMC's Resource Management Office and generally included the Support Service's functional accounts (or "E" accounts) .

Departmental level costs were directly identifiable within the producing center (CT), yet were indirect costs (versus direct costs) for only the individual DRG. At the departmental level, step-down schemes could have caused direct costs to be included also; yet, to estimate incremental costs, the direct costs needed to be extracted and quantified separately as their own level of costs. As implied, direct costs were traceable directly to the DRG. For CT, departmental (indirect) costs included such costs as nursing personnel costs on the Cardiology-CT (jointly shared) ward, while direct costs included costs such as laboratory costs when identifiable and directly traceable to individual patients for each DRG.

Regarding indirect and direct costs, there were two possible approaches to collect this data: 1) capturing patient-level costs if the desire was to dedicate time to this enormous task to achieve direct costs, understanding that this approach, when scrutinized, may not account for "waste" (or reorders) nor 100% of items used; or 2) capturing department-level indirect costs and, since expense data accounted for 100% of expense activity, a percentage could be taken that accounted for the functional area's portion of "costs." For this study, an effort was undertaken to capture patient-level costs for supply items and ancillary support. Indirect costs were collected using the second approach (above); although, the percentages used to allocate indirect costs (such as labor costs) were refined based on a patient-level collection of workload performed.

<u>Step 2: Accumulate only those costs that support CT (inpatient only), and remove those that are not relevant or affected by changes in volume or availability of services.</u>

Each cost must be assessed to determine whether it was affected or varied with the decision at hand. For instance, when deciding whether to add/delete patients by DRG it would be inappropriate to include the costs of equipment that was purchased in the past, which cannot be recovered, and which would not be replaced within the time frame spanned by the decision. This would be a sunk cost and not relevant for this analysis (in the short run).

Since some costs have both a fixed and variable component, it was important to assess the proportion of each. Unavoidable fixed costs which did not vary with the production of a service were not relevant since they were not affected by the decision. The fixed cost portion could be eliminated from each cost so

that only the variable component would be used. Assigning the percentage of the relevant (variable) portion of the cost was necessary to determine total differential costs.

Step 3: Cluster services into functional products (by DRG) for counting and costing in the spreadsheet model.

Determining the appropriate classification system was applicable for quantifying costs. For inpatient CT services, the DRG system was applicable. Like civilian hospitals, all inpatient care in military hospitals is classified using the DRG system. (Civilian hospitals use DRGs for care provided by the hospital and hospital staff, but not for the outside physicians directing the care. Current Procedural Terminology (CPT) codes are used by these physicians). Using the same classification system as civilian hospitals supported making comparisons of CHAMPUS paid claims costs for make/buy decisions. Although most of the patients included in this study were CHAMPUS eligible (55%), separating patient data by payor groups; i.e., CHAMPUS and Medicare, would be an option if, at a future time, this information was worthwhile.

Step 4: Identify the bases (cost drivers) which most accurately estimate causation of costs for each type of cost.

For each relevant cost, the appropriate base (or cost driver) was selected for external, departmental indirect and direct costs. The activities (or cost drivers) were identifiable by the service characteristics that drove the particular cost. For example, the laboratory cost was a result of weighted procedures required to provide an average patient with the individual service (CT). Typical cost drivers were weighted procedures and acuity (and Nursing Care Hours thereof). A guideline used to select the right cost drivers was that they had to clearly reflect the best cause of CT's costs.

Step 5: Count the activities or cost drivers for each DRG. (These are the individual characteristics that drive a CT function.)

Conceptually, the services consumed by an average patient for each of the DRGs had to be determined. The quantities identified for each service reflected published standards or workload measured, whichever was more accurate. Tracking and measuring the applicable activity's quantities by

provider presented the economic profiling of clinicians and permitted using this information for assessing practice patterns in CT.

Table 1 shows the method used to obtain costs for cost types on an aggregate basis and Table 2 describes the corresponding methods used to obtain these costs. In Table 1, the cost types were determined based on the MEPRS costs captured for CT. Also included are the cost types (like Pharmacy labor) for patient-level collected costs that ignored labor costs. These were the costs that accounted for CT's incremental costs. The "base" (or cost driver) column identifies the base that caused or correlated with the cost type incurred. The individual bases were selected for each cost type based on expert opinion (critical pathways or protocols) or measurement of the quantity of each basis consumed by each DRG. The "direct/indirect" column identifies whether the cost type was a departmental direct cost or departmental indirect cost. Product direct costs did not have cost drivers as their costs were directly recorded into the individual product costs. The "method" column in Table 1 specifies which methodology was used for each cost type identified. Table 2 explains the methods used to determine costs for each cost type identified in Table 1.

<u>Step 6: Estimate the costs of each CT cost driver.</u>

An estimation was needed of the new cost incurred of adding an additional unit of consumption (cost driver). For example, what new cost was incurred by perfusion services for one additional case? The quotient of the perfusion labor cost pool divided by the base (total minutes of perfusion time) was the incremental cost per minute of time.

<u>Step 7: Total the cost driver costs for all CT functions to determine the incremental cost of one unit, for each DRG.</u>

Aggregating the costliness for all CT functions of a service determined the costs caused by an additional unit of service. For example, the cost of an additional service (one DRG-assigned patient) in the lab meant adding the costliness of weighted procedures (lab) to the costliness of its personnel, reagents, quality control, and instrumentation costs. Aggregating external, departmental indirect and direct costs produced the cost of all patients treated within each DRG, and when divided by the number of patients gave the cost of care for a single (average) patient treated within a DRG.

**Table 1, Method for Obtaining Costs for Cost Types**

| COST TYPE | BASE | INDIRECT (I)/ DIRECT (D) | METHOD |
|---|---|---|---|
| Surgeon Labor | Protocol-C | I | 1 |
| Perfusion Labor | Protocol-P | I | 2 |
| Perfusion Supplies | Protocol-P | D | 3 |
| Contract (Perfusion Services) | Protocol-P | I | 2 |
| OR Nursing/ Paraprofessional | Protocol-O | I | 4 |
| OR Supplies | Protocol-O | D | 5 |
| Anesthesia Labor | Protocol-B | I | 4 |
| Anesthesia Supplies | Protocol-B | I | 5 |
| Equipment | Protocol-P | N/A | 6/7 |
| Nursing ICU | ICUAcuity | I | 8 |
| Paraprofessional ICU | ICUAcuity | I | 8 |
| Admin/Clerk ICU | Protocol-A | I | 2 |
| ICU Supplies | ICUAcuity | D | 5 |
| Nursing Ward 3A | Protocol-N | I | 8 |
| Paraprofessional 3A | Protocol-N | I | 8 |
| Admin/Clerk 3A | Protocol-A | I | 2 |
| Supplies Ward 3A | Protocol-N | D | 5 |
| Pharmacy | Wtd-procs-P | D | 9 |
| Pharmacy Labor | Wtd-procs-P | I | 10 |
| Diagnostic Radiology | Wtd-procs-X | D | 9 |
| Diag Radiology Labor | Wtd-procs-X | I | 10 |
| Lab | Wtd-procs-L | D | 9 |
| Cath Lab | Wtd-procs-C | D | 9 |
| Cath Lab Labor | Wtd-procs-C | I | 10 |
| Resp Therapy | Wtd-procs-R | D | 9 |
| Resp Therapy Labor | Wtd-procs-R | I | 10 |

The software model used to determine incremental costing consisted of a single spreadsheet, constructed in Lotus 3.4 version software. For each DRG product, an estimate of differential costs was performed. FY94 CHAMPUS reimbursement costs (professional and institutional costs) were obtained from the Retrospective Case-Mix Analysis System (RCMAS) for the San Antonio catchment area.

RCMAS is a government-owned patient-level case-mix analysis system that provides MTFs with access to clinical and management information. Reports from RCMAS provide the capability to review workload and utilization patterns at MTFs and civilian facilities, and to compare these patterns to normative data for use in analysis. Ad hoc reporting permits selecting criteria to retrieve; i.e., CHAMPUS

institution claim costs paid by DoD, physician claim costs paid by DoD or a combined institution and physician claim cost paid by DoD. This study used the combined CHAMPUS reimbursement costs.

For those DRGs that did not produce any outcomes in San Antonio for FY94, the RCMAS database for Region VI (under TRICARE, covering the Texas, Louisiana, Arkansas and Oklahoma) was used. For this study, CHAMPUS reimbursement information from RCMAS (San Antonio) and the number of cases analyzed included DRG's 75 (6), 76 (3), 77 (2), 105 (5), 106 (6), 107 (5), 108 (17), 398 (7) and 483 (4). For DRG's 101 (10) and 104 (21), CHAMPUS reimbursement information was obtained from the RCMAS (Region VI) database.

**Table 2, Method for Obtaining Costs**

| METHOD (1-10) | METHOD DESCRIPTION |
|---|---|
| 1 | Determine pay grade and quantity of surgical staff. Use W-2 Salary Information and Officer Salary Table to obtain annual physician bonus amounts and determine monthly bonus costs for staff. Add monthly bonus amounts to salaries listed in MEPRS Grade/Salary Table (Monthly). |
| 2 | Determine pay grade and quantity of staff. Use MEPRS Grade/Salary Table (monthly) or monthly contract costs to determine monthly personnel costs. |
| 3 | Collect perfusion supply costs for each case identified in this study. |
| 4 | Collect Minutes of Service (MOS) from OR system for each CT patient. Divide this by the total MOS for the month to determine the percentage of time performed on CT's patients. Multiply this percentage by the variable personnel costs (MEPRS) identified for the service (OR, Anesthesia). |
| 5 | Estimate supply costs for "typical" lung, valve and bypass patients to build protocol for service. |
| 6 | Equipment to be purchased specifically for CT should cases increase to 100/200 per year. |
| 7 | Equipment maintenance costs (fixed) per month of CT-specific equipment. These are avoidable fixed costs and listed in Table 1. |
| 8 | Determine total nursing acuity for entire ward. Calculate Nursing Care Hours (NCH) of entire ward based on acuity levels. Determine the percentage of NCH for CT patients versus other ward patients. Multiply percentage by variable unit personnel costs (MEPRS Grade/Salary Table), which are based on quantity and pay grade of the unit staff. |
| 9 | Report quantity of items/service from patient's medical record (MAR, Lab Reports, Radiology Results, etc.), and calculate weighted procedures based on quantity. |
| 10 | Calculate total weighted procedures assigned for CT patients. Divide this total by the total weighted procedures performed for the month to obtain a percentage. Multiply percentage by the personnel costs (MEPRS) for the service concerned. |

## PROCESS DETAILS

For each product (DRG) of CT, the software model produced a summary (Table 5 in appendix) of the quantity performed during September 1994, and the aggregate and incremental relevant costs, in comparison to CHAMPUS reimbursement costs (paid claims). The aggregate cost section was calculated by summing the costs derived from external (Table 6), departmental indirect (Table 7) and departmental direct costs (Table 8). The incremental unit costs were calculated by dividing the aggregate costs by the quantity of the DRGs (products). The addition/deletion decision under evaluation permitted some fixed costs to be avoided (or caused them to be incurred), and an estimate for the amount of those fixed costs was entered in the next three worksheets.

The external costs (MEPRS) worksheet (Table 6) reported for CT the attributed costs, their cost behaviors and the basis or cost driver believed to best reflect the cause of the costs. For each CT product, the share of the attributed cost from each cost center was reported based on that product's relationship to the basis or cost driver. The cost centers were directly obtained from the September 1994 MEPRS Step-down Analysis report; and the dollar amounts entered for each cost center were the amounts MEPRS charged from the step-down report. A relevance flag of "1" signified that the costs were affected by the decision, and an entry of "0" automatically eliminated that cost from all further calculations. For relevant costs, the percent variable entry reflected the best available information of the proportion of the dollar amount which actually rose and fell with changes in the basis or cost driver (volume). Opinions were obtained from the department chiefs running each cost center and considered the most affordable data source available for that data.

The "driver" column listed the name of the basis (or cost driver) believed to be causally related to the rise and fall in the variable part of the cost. Initially, WHMC may be limited to MEPRS allocation bases until such time as better bases or drivers could be identified and captured for the more significant costs. The calculations of the DRG-specific variable costs from each cost center were entered. The calculation method (embedded in the cells) was represented as:

(1) Cost center x Variable percentage=Aggregate Variable Cost

(2) Aggregate Variable Costs/Total Department-wide driver=Variable Cost per Unit Driver

(3) (Variable Cost per Unit Driver)x(Quantity of Driver for one Unit of Product)=Variable Cost per unit of that Product

(4) (Variable Cost per Unit of a Product)x(Number of Products produced )=Product-specific variable cost from that cost center

The departmental indirect costs worksheet (Table 7) reported all costs recorded directly against the production center, and then these costs were reduced by any costs that could be attached directly to CT's DRGs (products). The remaining costs were reported and attributed to products following the same process as external (MEPRS) costs above. The cost classes were obtained from the September 1994 MEPRS cost report for CT. The dollar amount entered was the MEPRS amount charged directly on the report or obtained from other means. The "relevance," "percent variable," and the "driver" columns served the same purpose as the preceding worksheet. The percent variability was determined through opinions given by the appropriate WHMC staff. The calculation sequence was the same as the preceding worksheet, except that an initial step subtracted any direct costs (from the following worksheet) from the amount attributed by this method.

The departmental direct costs worksheet (Table 8) reports for each DRG (product) those costs captured directly against it. The cost classes were identical to the preceding worksheet. This worksheet permitted the entry of those costs which were captured directly against a DRG (product). This was derived from the (following) supporting worksheet data captured by surgeon. For example, because of the high cost for an aortic valve, these costs were recorded at cost for the appropriate aortic valve replacement DRG, for the surgeon that performed the surgery; this worksheet contained linked data to the Cath Lab by Physician worksheet (Table 17).

The cost driver statistics worksheet (Table 9) reported for every basis (or cost driver) identified, the intensity of each DRG; i.e., the quantity of that basis consumed in producing a single unit of the product. Except for the column headings, this worksheet was used by the external and departmental indirect cost worksheets. The (abbreviated) driver names were sorted in alphabetical order as a database requirement and these names had to be identical to the driver names entered on the external and departmental cost worksheets. The "brief description" column permitted the fuller description of the cost driver. The "total"

column was calculated by the spreadsheet as the summation across all DRGs (products) of the product quantity times the units of the driver per product. Each of the units of driver per DRG (product) were entered directly based on this period's average; yet might be based on protocols, expert opinion or historical averages. Also, a row of units for a driver were linked to a supporting worksheet where detailed physician use was captured. For example, the number of laboratory weighted procedures ordered by each surgeon for each DRG, and the lab weighted procedures row reported the overall mean for each DRG (averaged by case, not physician).

The physician case workload worksheet (Table 10) recorded the quantity for each DRG (product) produced by each surgeon (clinician). If necessary, products that could not be specifically attributed to a specific clinician were possible to account for by adding an "unaccounted" identifier as one of the "physicians." This worksheet required the number of each DRG (product) produced by each surgeon. After entry into this worksheet, the product quantities on the summary page were linked from this worksheet to prevent any internal contradictions in the calculations.

Tables 11-19 recorded the aggregate number of cost drivers or basis statistics attributed for each surgeon (clinician), for each DRG (product). A weighted average driver was calculated and compared to the mean. These worksheets detailed the causes of direct costs or cost drivers. These worksheet data were linked to the supporting worksheets entries. This sequence of worksheets supported in communicating economic performance to clinicians or other interested administrators.

# CHAPTER III

## RESULTS

One major contribution from this study was discovering obstacles to the process of estimating differential costs and reporting them along with how they were resolved. The search for the most reliable data available was a major undertaking in this study. The processes and difficulties encountered are summarized, with further explanations provided in the Discussion.

1. Discrepancies existed between MEPRS data and what actually occurred (workload and expenses); which, in most cases, caused workload and cost data to be under-reported for CT.

2. Failure to properly assign Uniform Chart of Accounts (UCA) codes compromised CT's workload and cost data; which was largely due to patient transfer (by UCA code) information not being communicated to the "feeder" systems.

3. Difficulties encountered in the process of estimating differential costs primarily involved identifying and collecting reliable workload and cost data. Table 3 identifies the most reliable data source available at WHMC for workload and cost data.

**Table 3, Workload and Cost Data Sources for CT Differential Cost Study**

| | | |
|---|---|---|
| Laboratory | Patient's lab results, converted to weighted procedures | Patient-level costs from lab tests performed |
| Operating Room (OR) | OR system (Minutes of Service) | Patient-level based on average costs for lung, valve and bypass patients |
| Radiology | Patient's Radiology Narrative Reports, with procedures converted to weighted procedures | Patient-level, and included Radiology Labor costs |
| Anesthesiology | OR system (Minutes of Service) | Percentage of variable costs attributed to CT; and included Anesthesiology Labor (variable) costs |
| Respiratory Therapy | Respiratory Therapy's daily worksheets, with procedures converted to weighted procedures | Patient-level, and included Respiratory Therapy's Labor (variable) costs |
| Perfusion | Prospectively collected by case; calculated Minutes of Service | Patient-level |
| Cardiac Cath Lab | Patient-level; yet only includes primary procedures performed (no secondary) | Patient-level; yet included Cath Lab Labor (variable) costs |
| ICU | Daily log book with additional fields added to collect "time patient entered" and "time patient exited" | Patient-level; based on average ICU costs for lung, valve and bypass patients |
| Pharmacy | Medical Administration Record, converted to weighted procedures | Patient-level; and included Pharmacy Labor (variable) costs |
| Nursing (Ward 3A) | Ward documented acuity levels by patient, converted to nursing care hours | Patient-level; and included Ward Labor (variable) costs |

The results of this cost study's differential analysis model are presented in the appendix (Tables 5-19). The spreadsheet contained various worksheets which reflected different aspects of this study. As a note, further refinement of the data in these figures was possible should improved inputs become available.

The Summary (Table 5) showed that, according to the relevant, incremental costs resulting, it would be economically beneficial to add patients in DRG's 75, 77, 104, 105, 106, 107, 108, 398 and 483. DRG's 76 and 101 appeared to cost more at WHMC than what was reimbursed by CHAMPUS. Overall, across the department, CT was achieving total in-house savings despite the two DRGs operating at a loss. Individual relevant, incremental costs were reported in the Summary along with the corresponding CHAMPUS reimbursement costs. Tables 6-9 identified the external, departmental indirect and direct costs, as well as the cost driver statistics per DRG.

The supporting physician profiling worksheets (Tables 10-19) could assist the CT department in reviewing practice patterns by DRG for each practicing physician. Case-mix differences would be valuable to include in future interpretations of the physician-specific data and could better explain practice variances.

The spreadsheet model used in this study was a viable, cost-effective alternative for estimating differential costs and could be used for other cost objectives at WHMC, or any MTF. Learning how it could be used in one department certainly permitted greater possibilities for use in other departments.

It is a long-standing principle in cost accounting that information is costly to collect, but that it isn't worth anything unless it directly impacts on decisions (Finkler 1994). As such, another result of this study was to compare the information costs to perform this study against the overall in-house savings calculated for CT's DRGs. The information costs of one full-time captain (Grade O-3) using the MEPRS Grade/Salary table over a nine month period (September 1994-May 1995) at $5875 per month was $52,875. Other uncollected information costs included the time of other personnel who contributed to this study. However, the cost estimation of just the captain's costs should cover these other information costs since the "full-time" calculation was somewhat exaggerated as other duties beyond this study occurred in this period. Also, the "learning curve" cost; i.e., more time spent in the beginning than later in the study, would exaggerate this cost. As indicated in Table 5, the information costs to perform this study for CT more than paid for itself with DRG 106's savings alone ($85,713), not even including the other CT DRG's. Therefore, a decision to conduct this study in other departments may be influenced by the content

in this report, as well as the fact that the government's money spent to generate this study was cost-beneficial.

# CHAPTER IV

# DISCUSSION

A major contribution from this study was navigating through the obstacles to estimating differential costs using existing data. Using actual MTF data for this software model helped demonstrate that it could be done in real life. Based on the information cost of gathering and manipulating the data, this study resulted in a cost-beneficial endeavor.

The product list identifiers for this study were DRGs and Table 4 shows the DRG number and description for each CT product.

**Table 4: DRGs Performed by CT, September 1994**

| DRG | DRG DESCRIPTION |
|---|---|
| 75 | Major chest procedure |
| 76 | Other respiratory system OR procedures with complications |
| 77 | Other respiratory system OR procedures without complications |
| 101 | Other respiratory system diagnoses, age > 70, and/or complications |
| 104 | Cardiac valve procedure with pump and with cardiac catheterization |
| 105 | Cardiac valve procedure with pump and without cardiac catheterization |
| 106 | Coronary bypass with cardiac catheterization |
| 107 | Coronary bypass without cardiac catheterization |
| 108 | Other cardiovascular or thoracic procedure, with pump |
| 398 | Reticuloendothelial & immunity disorders with complications |
| 483 | Tracheostomy except for mouth, larynx or pharynx |

Cost finding for CT became a search for the best, available source of patient information (workload and expense) associated with CT. The MEPRS Code for CT (inpatient) was ABBA. Understanding the "feeder" systems' processes for determining ABBA's portion of workload and costs became a major

undertaking. The precise discrepancies existing between what the "feeder" systems were reporting to MEPRS and what was actually occurring (workload and expenses) were outside the scope of this study, yet are briefly mentioned when explaining the obstacles encountered in using the existing data to estimate the differential costs of CT. More importantly, it was valuable for this study to learn and document how these obstacles were overcome.

Since September's data was prospectively determined as the period of study, it permitted a day-by-day observation of the data being collected. Once the MEPRS reporting was complete and available for September, some initial indicators (such as number of admissions to CT) were compared. For number of admissions, MEPRS (Part I: Medical Expense Report) reported 15 admissions and 35 dispositions for September to ABBA. Data collected separately from secondary sources reported 27 admissions and 26 dispositions from September 1-30.

Further investigation into the discrepancy in admission and disposition data became a "data-tainting" factor throughout this data collection. First, the determining factor for becoming one of the 38 patients identified in this study was that all had CT surgical time performed in the month of September and were discharged from CT. Understandably, of these 38 patients, 11 were admitted in August yet had surgery in September, and 12 were discharged in October (with 3 admitted in August and discharged in October). Nevertheless, the workload and cost data were based on the entire episode of care and were patient-focused. MEPRS, however, was not patient-focused and reported, strictly, the number of patients admitted to ABBA and discharged from ABBA in September.

Second, of these 38 CT patients, 9 (24%) were not reported as discharged from ABBA. The assignment of ABBA to the patient was crucial in the reporting of workload and cost information. The reason these 9 patients were not discharged from ABBA was because they were admitted to Cardiology or Internal Medicine; although, they were transferred to the CT ward and received a CT attending physician. In the AQCESS system, if a change of service was not requested from the ward to the admitting office, the entire admission (and any incurred workload and expenses) went unchanged. Any cost estimates obtained for the model using this data would be suspect (and likely under-reported) given the limitations of the information reported to MEPRS.

This problem was magnified when considering the ancillary and support services that report or completely fail to account for workload and expenses. For instance, the Cardiac Catheterization Lab (or "Cath Lab") reported their monthly workload for patients by MEPRS code. One entry point for a patient was the Cath Lab and based on the evaluation, a transfer to CT for bypass surgery may result. Consequently, when the Cath Lab workload was calculated, it was reported under the MEPRS code the patient was assigned at the time they received their Cath Lab services. So, it was understandable that September's workload for Cardiac Cath Lab showed 2 patients for ABBA (of which neither were discharged from CT) when really there were 24 CT patients. These 24 patients were not identified as ABBA patients at the time of their Cath Lab service and since there was no follow-up to the Cath Lab regarding patient transfer updates, Cath Lab workload data for CT was under-reported. Lost or unaccountable workload appeared to significantly affect the reliability of MEPRS data for workload and expenses given this current process of transferring MEPRS codes, especially at a facility like WHMC with many specialties having individual MEPRS codes.

Consequently, when further research into other "feeder" systems showed this same trend in reporting (or lack of reporting) data to MEPRS, the source for most of the workload data became the patient's medical record. Extracting information from the patient's medical record became a very tedious and laborious information gathering task; yet, it contained the most reliable patient data available.

Following is an examination of the processes and difficulties encountered in obtaining the data to estimate the relevant, differential costs for this study:

<u>Laboratory (Table 11):</u>

Laboratory workload was reported according to nationally standardized weighted procedures from the College of American Pathology (CAP) standards. Unfortunately, WHMC's lab system was not capable of reporting lab orders by patient. Initially, the likely data source for laboratory procedures appeared to be the lab system's ad hoc reporting of the lab procedures by UCA, by provider since it reported, by MEPRS code, by physician, the number of patients, number of tests completed, costs/patient and total cost. However, upon further evaluation, it became apparent that these reports contained erroneous information such as showing active lab orders for providers that had relocated from WHMC two years ago. Following

this realization, the use of another of the Lab system's report that breaks down lab costs by UCA (MEPRS), provider, and test appeared promising to validate against patient-level findings; however, it too contained erroneous data.

Consequently, the best source of lab data became the patient's medical records copy of lab results. The lab results provided in the medical record reported all lab tests ever performed on the patient. After eliminating test results received outside the period of this study, the task became cumulating the data into a spreadsheet, by patient, by lab test. Weighted procedures were assigned based on the number of each test performed. MEPRS reported 43,981 weighted procedures (for Clinical Pathology, Anatomical Pathology and Blood Bank); whereas, this study concluded a figure of 46,393 was more accurate. Costs were assigned based on the quantity of tests performed. Each laboratory test's cost included the cost of reagent, quality control, instrumentation, general overhead and salaries/benefits. Variable costs were estimated to be 48% of these lab costs. Based on the quantity of lab procedures performed, this study concluded CT's portion of lab costs totaled $26,161.

Operating Room (Table 12):

The MEPRS obtained Operating Room (OR) workload (minutes of service, or MOS) based on entries made in the Operation Report (SF 516) which were then entered in the OR system. The general formula used to determine OR time (MOS) in the OR system was as follows. A factor of 4.01 (number of staff) was a constant multiplier in all OR cases; and:

Base Time (Anesthesia Stop Time-Anesthesia Start Time) + Turnaround Time (20 min.) x # staff (4.01).

A review of the transferred file from the OR system to MEPRS indicated that of the 38 CT patients receiving surgery in September, one patient was not identified as a CT patient due to an error in the department code assigned. The OR system used department numbers, not MEPRS codes, to assign patients to services. CT was Department 10 and the patient entered in error was assigned to General Surgery, which was Department 1. Two other patients were entered in the OR system as CT patients since their primary surgeon was a CT surgeon; yet, neither was discharged nor attended by the CT surgeon beyond surgery. These two patient's OR workload and expense data were disregarded in this

study. This explained the difference in MEPRS figures for OR minutes of service (48,746) compared to this study's finding (37,594).

OR expenses in MEPRS reflected the percentage of CT's share based on the workload in comparison to all operations performed in September. Since CT's homogenous categories of lung, valve and bypass could be differentiated enough in supplies used for these cases, this study identified OR costs for each of these categories, such as a bypass case averaged $2,417 in OR supply costs. These direct costs were applied to the corresponding DRGs. There existed the possibility of bias in recording direct costs in this manner since logistics costs and waste were ignored.

The improvement to the OR MOS produced a better percentage to calculate OR labor costs. The MEPRS system calculated 8.16%; however, improving this figure through an account of actual workload performed produced a percentage of 6.3%. Multiplying this percentage by September's OR personnel costs (nursing, paraprofessional and administrative personnel) of $422,928 (after first subtracting the fixed labor costs), leaves a remainder of $352,793 as the variable component used to allocate CT's portion of OR labor costs. Consequently, this improved OR labor cost was used to allocate CT's portion of costs.

Radiology (Table 13):

Radiology workload was reported to MEPRS using nationally standardized weighted procedures. As with all the other services encountered, there existed no patient-level reporting of procedures performed other than what was contained in the patient's narrative reports, which reported the results of each procedure. The Radiology staff printed the narrative reports for each of the 38 patients. It became another major endeavor to collect and measure the radiology procedures by patient and convert them to weighted procedures. Comparing the monthly MEPRS report of Radiology data showed a significant difference in workload reported which lead to further evaluation of the patient data. As such, the MEPRS' UCA coding was again the culprit in misrepresenting workload for CT. With weighted procedures being the method used to report radiology workload, this loss in workload appeared significant.

Radiology direct costs were obtained from Radiology technicians who calculated the supply costs for each of the procedures performed on CT's patients. Since these costs were limited to supply costs, it necessitated calculating Radiology's variable labor cost and multiplying it by the percentage of CT's

workload. MEPRS reported a percentage of 2.64%; whereas, this study concluded a percentage of 4.39% was more accurate.

Anesthesiology (Table 14):

Anesthesiology workload was determined based on entries obtained from the Operation Report (Standard Form 516) and entered into the OR system. The general formula used to determine Anesthesia time (minutes of service) follows. A factor of 3.5 (number of staff) was a constant multiplier in all anesthesia cases.

Base Time (Anesthesia Stop Time/patient "rolls out"-Anesthesia Start Time/patient "rolls in") x # staff (3.5).

Anesthesiology indirect costs were used since the only direct cost data available were the pharmaceuticals used for each CT patient. Anesthesiology's variable labor costs were multiplied by the percentage of CT's workload, based on MOS. MEPRS reported a percentage of 8.33%; whereas, this study concluded a percentage of 8.2% was more accurate.

Respiratory Therapy (Table 15):

Respiratory Therapy workload data was obtained from manually entered source documents which were recorded by patient, and by technician for each shift. The recorded workload of these three shifts was manually compiled into a daily record. Monthly, these records were tabulated to produce the monthly workload data for MEPRS. Understandably, collecting Respiratory Therapy data by patient was time-consuming considering the voluminous paperwork involved.

Difficulties were encountered with Respiratory Therapy workload data. First, since the reporting of Respiratory Therapy's data was manually collected by multiple technicians, the correct entry of data became critical. Among the 38 patients included in this study, 3 sets of patients had the same last name, and 3 more shared another last name. When entering the patient's data onto the worksheets, the technicians did not differentiate these patients with first names, nor did they always specify the patient's room number. This lack of differentiation caused these 9 patients to be dismissed from the Respiratory Therapy workload entry. Second, with a manual system of data collection and tabulation, there were errors in calculating totals of individual procedures, which would cause misrepresentation of data to

MEPRS. Third, October's compilation of worksheets were lost and unable to be located, so the patients that had extended stays into October that received respiratory therapy were not included. Fourth, since technicians were assigned patients by MEPRS code, it was evident that the patients not assigned (by transfer) to CT were, again, under-reported for Respiratory Therapy.

Respiratory Therapy reported weighted procedures to MEPRS. The weighted procedures were taken from national standards for respiratory therapy. Respiratory Therapy procedure costs were provided as direct costs, yet only reflected supply costs. Since Respiratory Therapy procedures primarily involved manpower and equipment, the variable labor costs were included. The CT portion (percentage) of total weighted procedures was determined and multiplied by the variable labor costs. September's MEPRS reported a percentage of 8.56%; whereas, this study concluded a percentage of 16% was more accurate.

Perfusion (Table 16):

Perfusion's labor and supply cost drivers were based on a protocol obtained from actual workload and cost data prospectively collected by its staff. Table 16 reports the Minutes of Service (MOS) by physician and DRG and includes total "pump" (heart-lung machine) time, any surgical assist time and perfusion assist time (technician set-up and break-down time) per case. The MOS collected on these patients contributed to the protocol developed for perfusion. Of the 38 patients included this study, 27 received perfusion services; i.e., they involved either a bypass or aortic valve replacement surgery requiring a heart-lung machine.

Perfusion services at WHMC were provided by 3 active duty perfusionists, 2 contract perfusionists and 1 civilian perfusion technician. The MEPRS Grade/Salary Table was used to calculate the monthly perfusion (variable) labor costs for the active duty perfusionists and civilian technician. The monthly contract cost reflected the labor costs for the 2 contract perfusionists.

MEPRS separately reported perfusion surgical time and administrative time; yet, for some unknown reason, MEPRS consistently reported whatever the surgical MOS were as workload for both surgical and administrative time. For instance, September's MEPRS figures were 50,850 MOS in surgery and 50,850 minutes for administrative time. Evidently, this duplication occurred in every month's MEPRS reporting, even though the source document prepared by the Perfusion staff showed a clear delineation between

surgical time and administrative time. The perfusionist who prepared this information reported this reporting error to the MEPRS staff with no results.

For this study, the perfusionists collected patient-level workload and cost data for the 27 CT patients receiving perfusion services in September. Perfusion reported to MEPRS 50,850 minutes for surgical time provided to CT patients. Of the 50,850 minutes, 13,755 perfusion minutes (229 hours) were attributed to "surgical" time with CT patients (the perfusion staff also report their in-house study time, Cath Lab, OR/trauma and post-op coverage time as "surgical" time). When non-surgical time was extracted from the 50,850 minutes (848 hours) reported, 37,095 minutes (618 hours) of non-surgical time remained, yet reflected dedicated perfusion minutes. This worked out to an average of 927 minutes for non-surgical time added to the surgical time for each patient receiving perfusion services in September (27 as CT patients, 13 others).

Administrative time was obtained from Perfusion's monthly source document (same document prepared for the MEPRS staff) rather than the duplicated surgical time figure. For September, this figure was 5940 minutes, excluding leave time (1920 minutes, or 32 hours). This resulted in an average of 149 minutes of Perfusion administrative time per patient, or a total of 4023 minutes (or 67 hours) for CT patients.

Perfusion supply costs per individual patient were tracked by perfusion for the month of September. Perfusion equipment was dedicated to CT. For this decision of adding/deleting individual patients by DRG for CT services, in the short-run, equipment costs and depreciation were not relevant and purchased equipment costs were sunk costs. Had it been a long-run decision, these costs would be considered relevant; i.e., replacement costs for equipment and depreciation for equipment. All existing perfusion equipment had the "capacity" for usage if patient cases were added or deleted. However, should CT increase cases to 100-200 per year, the equipment cost ($155,500) was provided and may be "activated" in the spreadsheet should this decision arise.

Cardiac Catheterization Lab (Table 17):

As mentioned earlier, the Cardiac Catheterization Lab (or "Cath Lab") was not notified of patient transfers for patients receiving Cath Lab services. Consequently, the Cath Lab workload data was under-reported for CT. Without patient transfer notification, Cath Lab workload ended up being reported under Cardiology or Internal Medicine-- two typical admission entry points for patients whom, following Cath Lab results, were ultimately referred and transferred to CT.

The September workload figures for Cath Lab were reported to MEPRS as 116.7 weighted procedures, for two procedures performed on two patients. This data's over-reporting was explainable. First, the calculation reported for Cath Lab workload reflected procedures performed on two patients, whom had the same procedure performed (simple left heart catheterization, weighted procedure of 47.5). The reason the calculation was 116.7, and not 95 (47.5 x 2) was that just the primary procedure code was reported by the Cath Lab's system. Another 21.7 weighted procedure's worth of secondary procedures were performed yet were unavailable from the system.

Second, since the Cath Lab was not notified of patient transfers/discharges, workload attributed to CT was grossly under-reported. September's workload for CT should have been reported at a minimum of 2166.5 weighted procedures (for 20 verified CT patients) while it was only reported as 116.7. Also interesting was the finding that the two patients reported as CT patients were, in fact, not CT patients at all! So, Cath Lab workload attributed to CT was significantly under-reported due to the lack of discharge/transfer of service updates for their patients.

Cost data for the Cath Lab was collected based on cost information supplied by their staff for the individual procedures performed. The CT patients only utilized four different procedures from the Cath Lab--a simple left heart catheterization, angioplasty, right and left heart catheterization and pacemaker insertion. The pacemaker cost of $5,400 was directly assigned to the product (DRG) of the patient receiving this procedure in the Cath Lab.

As a note, having a catheterization performed during the patient's episode of care while at WHMC was the determinant in choosing between DRG codes of 104 or 105, and 106 or 107. DRG's 104 (valve replacement with catheterization) and 106 (bypass with catheterization), were determined based on a

report in the patient's medical record. If the patient received their catheterization elsewhere or not at all, then DRG's 105 (valve, no catheterization) and 107 (bypass, no catheterization) were assigned.

For the 20 identified CT patients, 3 patients received the wrong DRG coding from Medical Records--2 bypass patients were assigned to DRG 107, yet had catheterization procedures documented in their medical records. On the other hand, another bypass patient (assigned to DRG 106) did not have any record of having a catheterization procedure and should have been assigned DRG 107. Although this was not purely a Cath Lab problem, it did lend itself to further work with Medical Records to assign correct DRGs which were entirely based on this area's work.

Since the cost information supplied by the Cath Lab only included supply costs, the variable labor costs were also included. Based on the refined weighted procedures for the Cath Lab, a percentage of 14% was used instead of the MEPRS percentage of .75% to multiply by the monthly variable labor costs of $45,622.

Intensive Care Unit (Table 18):

The ICU used by CT (called "IJ") was typically shared with patients assigned to Cardiology; CT did not have exclusive use of it. Since ICU workload was measured in hours of service, it became apparent how crucial it was to account for the patient's entry and exit times. Therefore, for the month of September, the IJ staff entered in their regular log book of patient admissions, the time entered and time transferred out.

This accuracy in reporting entry/exit times was useful when comparing the workload (hours of service) MEPRS received from the AQCESS system to the workload calculated from the ICU's log book entries. At the time of this study, the procedure used to enter ICU admissions into AQCESS was not ideal to capture actual length of stay data. Evidently, obtaining the patient card was the driver in the "admission to ICU" process which jeopardized the precise entry of admission time. The emphasis placed on the ward clerk's duty to have a card in place on the ICU when the patient arrived prevailed over the actual admission time entered in AQCESS. This resulted in patients being admitted (reported) to the ICU well before the actual admission time. Since admission time defaulted to system time, ICU workload (hours of service) reported to MEPRS (2524 hours) was improved to 2939 hours.

ICU costs were obtained by the ICU staff who collected supply costs from the patient's flow sheet located in the patient's medical record. These direct costs were grouped by DRG category of lung, valve and bypass, and reflected an average supply cost for each DRG category. As with any average costing, this method of reporting costs may include biased data. ICU's variable labor (nursing, paraprofessional and administrative) costs were multiplied by the percentage of ICU workload attributed to CT's patients. MEPRS reported this percentage as 80.61%; whereas, this study concluded 94% was more accurate.

Pharmacy (Table 19):

Obtaining reliable Pharmacy data required the most effort of any type of cost external to CT. The initial assumption was to use the Pharmacy's National Data Corporation (NDC) system's patient profiles to obtain workload and cost data. The patient profiles listed, by patient, the medications (and quantity) ordered during the inpatient episode of care. Procedurally, pharmacy orders were faxed from the ward to the Pharmacy for entry into the NDC system. As such, errors in data entry of social security numbers and other data occurred. Among the 38 CT patients, 3 patients were altogether unfindable in the pharmacy system, likely due to an error in entry of patient information, and 1 patient had a wrong social security number entered.

Following the entry of this data, it became apparent that the data presented on the patient profiles were not the same as those reported to MEPRS. Further investigation revealed that the NDC system reported different data to MEPRS than that reported in its patient profiles, it only reported pharmacy orders for patients while they were on the ward; i.e., any medications ordered while in the ICU were not reported to the Pharmacy and therefore not obtainable from the patient profile. A phone call to NDC confirmed this fact. In addition, the patient profile listed quantities of medication based on a unit-dose system. This method of reporting pharmacy workload assumed that all doses were the same and did not reflect workload actually performed. For instance, if a medication order requested 2 Lopressor tablets, every 2 hours, the patient profile reported 24 tablets dispensed; whereas the number reported to MEPRS was 12--the number of doses.

Other observations of data errors were also made. (1) The reporting of workload for bulk items appeared inaccurate since whoever entered the data into the NDC system did so by usually assigning a

single MEPRS code to the entire pallet of bulk items; so, it ended up that whichever unit was entered received all the workload (weighted procedures of 2 each) assigned to it. (2) The Pharmacy was not notified of patient discharges so, as a safeguard measure, their system permitted the use of a fictitious “transfer ward” where they transferred patients whom they "think" were discharged. This meant patients assigned to the “transfer ward” accumulated active pharmacy orders (and reporting them as active to MEPRS) until the actual discharge was performed in the system. Patients were maintained on the "transfer ward" for as long as two weeks. This “transfer ward” measure was taken to avoid the task of having to "reactivate" patients that may have been erroneously discharged from the system. (3) The NDC system was designed to allow “free-form” text entry of orders. This feature compromised the accountability of orders entered. For instance, if a pharmacy item's order "quantity" is defined in the system as milliliters (ml's), and the technician enters number of "puffs" (exhalations) instead, the quantity entered would be meaningless and reported in error. 4) Pharmacy orders written as PRN ("as needed") continued to be active (and counted) until discontinued and actual administrations of these orders were not recorded in the NDC system from the ward to account for the administration of these orders. 5) Ward stock items appeared to be administered without notification to the Pharmacy; therefore, the Pharmacy workload data reported to MEPRS was suspect.

The best data source for medications dispensed to the 38 CT patients became the Medication Administration Record (MAR), located in the patient’s medical record and the ICU’s flow sheet. This emerged as a time-consuming effort with considerable Pharmacy and ICU staff support added to interpret the patient’s MARs and ICU flow sheets.

Cost data were obtained from the Pharmacy’s stockroom item listing and costs were calculated in unit-dose metrics. The spreadsheet developed for Pharmacy contained costs by tablet (.15), injectible (2), IV solution (2) and controlled substance (.15). The quantity of pharmaceuticals administered was recorded based on the MAR entries obtained from the patient’s medical record with a cost determined. Weighted procedures were calculated based on the quantity entered for each tablet, injectible, IV solution and controlled substance.

Since the supply item cost was all that was included in the Pharmacy costs, it became apparent that to ignore the Pharmacy's (variable) personnel portion of costs would be underestimating costs. Therefore, the weighted procedures obtained (above) for Pharmacy were used to determine CT's portion of the Pharmacy's variable personnel costs. MEPRS reported September's Pharmacy personnel costs were $417,016, with .57% allocated to CT. This study concluded a percentage of 3.6% was a better reflection of CT's pharmacy costs based on weighted procedures determined for CT. Extracting the fixed portion of Pharmacy's labor costs left $152,709 by which to multiply CT's 3.6%.

Nursing (Ward 3A):

The essence of the current problem with MEPRS was that nursing costs were averaged into the Occupied Bed Day (OBD) for the unit. As a result, all patients in a given unit of WHMC were factored as if they all consumed the same amount of nursing care, when we clearly know patients have different nursing requirements. We should be able to collect costs more accurately and be able to determine different amounts of resource consumption.

WHMC had a patient classification system (required for accreditation) called Nursing Data Management System (NDS). It required the rating of patients based on their nursing resource requirements. It may not be entirely accurate for all patients; however, patient resource consumption would generally match with what the classification system showed. Although not all patients within a specific DRG would consume the same nursing resources, we could find an average amount of nursing service resources could be found for each type of DRG.

For each patient in each DRG, it was found, on average, how many days of the patients' stay were at each acuity level. CT's patients required acuity levels 3, 4, 5 and 6. For each acuity level, nursing care hours (NCH) were calculated. Acuity level 3 involved approximately 11 hours; level 4, 18 hours; level 5, 27 hours; and level 6, 37 hours. NCH were used to develop the protocol for nursing and paraprofessional workload which was then used to determine the percentage of nursing and paraprofessional labor costs attributed to CT's patients. Once the variable component of the ward's labor costs were identified, the percentage obtained from NCHs for CT (32%) patients was multiplied by the variable nursing and paraprofessional labor cost.

## CHAPTER V

## CONCLUSIONS

The data obtained from the MEPRS system produced full-cost data based on certain types of data captured and reported. The types of information included workload (performance indicators/measures, expenses (financial and other expenses), and man-hours (number of full-time equivalents). Accuracy in reporting from the various "feeder" systems was essential to ensure reliable data. As such, without reliable data entered, any "costing" results were suspect.

Based on this study's conclusions, the processes and difficulties encountered in using a simple spreadsheet model of existing data to estimate the differential cost of adding/deleting individual patients in a DRG serviced by the CT department at WHMC was a time-consuming task, yet it was cost-beneficial to collect. Using this study's conceptual model to estimate differential costs was clearly justified in cost savings given the information costs in doing so.

The processes and difficulties of educating "estimators" to obtain the "% variable" estimates ranged in difficulty from requiring no explanation to providing a complete introduction to variable and fixed costs. The general observation was that although WHMC emphasized the business of health care, "fiscal resolve" was still in its infancy for the majority of personnel encountered whom significantly impact the delivery of health care. One possible reason this short-fall existed appeared to be a trend across all departments encountered--that individuals impacting the delivery of care have not been made aware of, nor held accountable (nor receive incentives) for, the effects of their contribution to data reliability.

Across WHMC, this study generated a lot of questions about costs; yet, what interested most staff members was the workload data obtained for each of the individual departments. Variances between what MEPRS reported and what was reported by patient produced a wealth of interest. Reporting workload by DRG appeared to the staff a useful way to analyze resource use--versus by monthly activity (MEPRS). After reviewing variances between the two data sources, this study's results became a useful source by which managers could begin to influence behavior.

The results of this study revealed the cost behaviors of CT; and, armed with this information, management attention may focus on the cost drivers that account for CT's resource consumption. Also

with the introduction of capitated budgets, interest may focus on the need for better costing systems--to both monitor and control patient costs. This analysis tool did not serve as a patient-level cost accounting alternative; however, it would provide health care managers at WHMC assistance in implementing new strategic directions, such as make/buy decisions. Answering questions like, "Would we be better off with a contract than without one?" could now be answered using estimated differential costs rather than full costs.

# CHAPTER VI

## RECOMMENDATIONS

Continuous refinement of the reported data would be expected to produce a more reliable picture of the costs involved in the future. Attempts to improve the education of personnel entering information into the "feeder" systems would tremendously alleviate the inconsistencies and problems existing with the information reported to MEPRS.

Another recommendation would be to evaluate the resources used and the cost behaviors of CT physicians. The physician profiling feature of this spreadsheet was only a beginning into tracking and monitoring practice patterns. Incorporating case-mix differences would provide more accurate information relating to individual cases (DRGs).

Finally, this study would be simple, flexible and cost-beneficial to implement across other departments at WHMC. The fact that real life data was used further supports additional efforts with other departments, since much of the process and data purification need not be repeated or, at least, rediscovered. By providing "bottom-line" information, WHMC will be equipped with fuller knowledge of the costs of their services.

As Peter B. Turney (1991) said, "Dealing with today's competition is challenge enough and responding with wrong information could lead us in a losing battle." Therefore, there exists a need for a method to identify differential costs and, only then, should it reveal the problems to be tackled and the opportunities to be explored rather than hiding the problems and failing to identify opportunities.

Table 5: Total Incremental Costs and Incremental Costs for each Service

## Department: Cardiothoracic Surgery  Period: Sept 1994

| Product List by DRG | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brief description of service: | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| Quantity Provided during the period: | 5 | 1 | 1 | 1 | 3 | 2 | 18 | 3 | 1 | 1 | 2 |
| **Aggregate Costs** | | | | | | | | | | | |
| External Costs | $72.16 | $28.87 | $14.43 | $14.43 | $43.30 | $28.87 | $259.79 | $28.87 | $14.43 | $14.43 | $28.87 |
| Indirect Costs | $34,080.57 | $4,733.34 | $5,128.95 | $4,649.28 | $33,347.55 | $21,185.92 | $143,293.95 | $24,409.69 | $6,743.33 | $2,283.22 | $57,018.07 |
| Direct Costs | $23,203.00 | $4,634.00 | $2,212.00 | $2,862.00 | $50,737.00 | $28,181.00 | $138,568.00 | $19,459.00 | $5,614.00 | $506.00 | $67,399.00 |
| Total: | $57,355.74 | $9,396.21 | $7,355.38 | $7,525.71 | $84,127.85 | $49,395.79 | $282,121.74 | $43,897.56 | $12,371.77 | $2,803.65 | $124,445.93 |
| **Incremental Unit Costs** | | | | | | | | | | | |
| External Costs | $14.43 | $28.87 | $14.43 | $14.43 | $14.43 | $14.43 | $14.43 | $9.62 | $14.43 | $14.43 | $14.43 |
| Indirect Costs | $6,816.11 | $4,733.34 | $5,128.95 | $4,649.28 | $11,115.85 | $10,592.96 | $7,960.77 | $8,136.56 | $6,743.33 | $2,283.22 | $28,509.03 |
| Direct Costs | $4,640.60 | $4,634.00 | $2,212.00 | $2,862.00 | $16,912.33 | $14,090.50 | $7,698.22 | $6,486.33 | $5,614.00 | $506.00 | $33,699.50 |
| Total: | $11,471.15 | $9,396.21 | $7,355.38 | $7,525.71 | $28,042.62 | $24,697.89 | $15,673.43 | $14,632.52 | $12,371.77 | $2,803.65 | $62,222.97 |
| **Abandonment/New Service Costs** | | | | | | | | | | | |
| Quantity affected | 5 | 1 | 1 | 1 | 3 | 2 | 18 | 3 | 1 | 1 | 2 |
| Aggregate Variable Costs | $57,356 | $9,396 | $7,355 | $7,526 | $84,128 | $49,396 | $282,122 | $43,898 | $12,372 | $2,804 | $124,446 |
| Avoidable Fixed Costs | $0 | $0 | $0 | $0 | $103 | $103 | $103 | $103 | $103 | $0 | $0 |
| Total in-house: | $57,356 | $9,396 | $7,355 | $7,526 | $84,231 | $49,499 | $282,225 | $44,001 | $12,475 | $2,804 | $124,446 |
| Incremental CHAMPUS Payment | $80,187 | $7,032 | $86,403 | $3,491 | $28,389 | $28,387 | $20,441 | $17,791 | $24,492 | $13,074 | $81,083 |
| Total CHAMPUS | $400,935 | $7,032 | $86,403 | $3,491 | $85,167 | $56,774 | $367,938 | $53,373 | $24,492 | $13,074 | $162,166 |
| **In-house Savings (Loss):** | $343,579 | ($2,364) | $79,048 | ($4,035) | $936 | $7,275 | $85,713 | $9,372 | $12,017 | $10,270 | $37,720 |

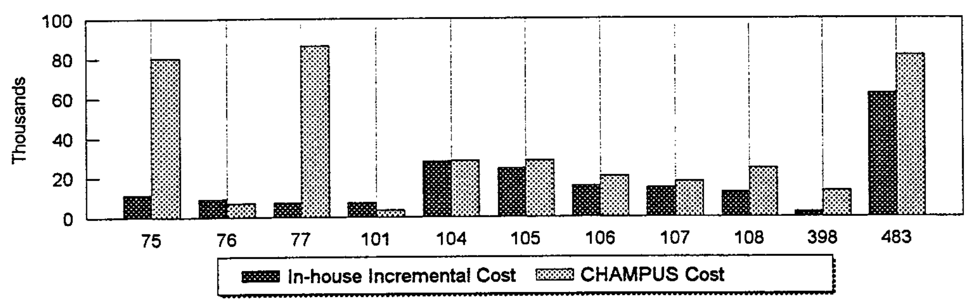

Table 6: External Costs Charged to the Department by the Step-down System

## EXTERNAL COSTS (MEPRS) Period: Sept 1994

| Cost Center | Amount | Relevance | % Variable | Driver | 75 Major Chest | 76 Resp w/cc | 77 Resp w/o cc | 101 Resp>70cc | 104 Valve/Cath | 105 Valve/NC | 106 Bypass/Cath | 107 Bypass/NC | 108 Other Card | 398 Ret&Im>70 | 483 Tracheost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inpatient Depreciation | $7,441 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Other Base Support Svc | $364 | 1 | 1% | DRG-wts | $0 | $0 | $0 | $0 | $0 | $0 | $2 | $0 | $0 | $0 | $0 |
| Command | $145 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Managed Care | $44 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Special Staff | $242 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Legal Office | $31 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Health Promotion Program | $14 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Administration | $1,427 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Personnel & Administration | $244 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Committees | $82 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Information Systems | $621 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clinical Management | $1,059 | 1 | 1% | DRG-wts | $1 | $1 | $0 | $0 | $1 | $1 | $5 | $1 | $0 | $0 | $1 |
| Clin Mgt - Div of Med | $28 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div of Surg | $56 | 1 | 1% | DRG-wts | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div of Nursing | $162 | 1 | 1% | DRG-wts | $0 | $0 | $0 | $0 | $0 | $0 | $1 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div Nursing, Me | $59 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div Nursing, Sur | $18 | 1 | 1% | DRG-wts | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div Nursing, Mat | $83 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Clin Mgt - Div Nursing, CT | $12 | 1 | 32% | Protocol-N | $1 | $0 | $0 | $0 | $0 | $0 | $2 | $0 | $0 | $0 | $0 |
| GME Support | $305 | 1 | 4% | DRG-wts | $2 | $1 | $0 | $0 | $1 | $1 | $6 | $1 | $0 | $0 | $1 |
| Ed & Training Program Spt | $298 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Medical Ethics | $2 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Peacetime Exercises/Disas | $5 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Third Party Collections Adr | $775 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Communications | $265 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Dietetics In-house | $9,277 | 1 | 3% | DRG-wts | $37 | $15 | $7 | $7 | $22 | $15 | $132 | $15 | $7 | $7 | $15 |
| Inpatient Clinical Dietetics | $1,315 | 1 | 3% | Wtd-procs | $5 | $2 | $1 | $1 | $3 | $2 | $19 | $2 | $1 | $1 | $2 |
| Inpatient Administration | $6,602 | 1 | 3% | DRG-wts | $26 | $10 | $5 | $5 | $16 | $10 | $94 | $10 | $5 | $5 | $10 |
| Recovery Room | $975 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Nuclear Med | $2,819 | 0 | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | $30,976 | | | | $72 | $29 | $14 | $14 | $43 | $29 | $260 | $29 | $14 | $14 | $29 |

Table 7: Departmental Costs Recorded Specifically Against the Department

## Departmental Indirect Costs

**Period: Sept 1994**

| Cost Type | Gross $ | - Direct $ | Indirect $ | Relevance | % Variable | Driver | 75 Major Chest | 76 Resp w/cc | 77 Resp w/o cc | 101 Resp>70cc | 104 Valve/Cath | 105 Valve/NC | 106 Bypass/Cath | 107 Bypass/NC | 108 Other Card | 398 Ret&Im>70 | 483 Tracheost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5 | 2 | 1 | 1 | 3 | 2 | 18 | 3 | 1 | 1 | 2 |
| Surgeon Labor | $51,834 | | $51,834 | 1 | 67% | Protocol-C | $4,656 | $559 | $1,001 | $419 | $3,261 | $2,066 | $17,047 | $2,422 | $725 | $248 | $2,326 |
| Perfusion Labor | $21,517 | | $21,517 | 1 | 92% | Protocol-P | $0 | $0 | $0 | $0 | $2,167 | $1,236 | $11,804 | $2,052 | $586 | $0 | $1,951 |
| Perfusion Supplies | $48,548 | $48,548 | $0 | 1 | 100% | Protocol-P | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Contract (Perf Svcs) | $5,834 | | $5,834 | 1 | 92% | Protocol-P | $0 | $0 | $0 | $0 | $587 | $335 | $3,201 | $556 | $159 | $0 | $529 |
| OR Nursing/Paraprof'l | $352,793 | | $352,793 | 1 | 6% | Protocol-O | $2,669 | $228 | $628 | $238 | $2,085 | $1,356 | $11,212 | $1,659 | $440 | $152 | $1,558 |
| OR Supplies | $103,800 | $103,800 | $0 | 1 | 100% | Protocol-O | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Anesthesiology Labor | $481,702 | | $481,702 | 1 | 8% | Protocol-B | $5,315 | $638 | $1,143 | $479 | $3,722 | $2,358 | $19,459 | $2,764 | $827 | $283 | $2,656 |
| Anesthesiology Supplies | $31,686 | | $31,686 | 1 | 100% | Protocol-B | $4,248 | $510 | $913 | $383 | $2,975 | $1,885 | $15,553 | $2,209 | $661 | $226 | $2,122 |
| Equipment | $115,500 | | $115,500 | 0 | 0% | Protocol-P | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Nursing ICU | $67,809 | | $67,809 | 1 | 94% | ICUAcuity | $5,837 | $808 | $323 | $808 | $3,071 | $5,244 | $21,660 | $3,610 | $1,149 | $0 | $21,229 |
| Paraprof'l ICU | $33,236 | | $33,236 | 1 | 94% | ICUAcuity | $2,861 | $396 | $158 | $396 | $1,505 | $2,570 | $10,616 | $1,769 | $563 | $0 | $10,405 |
| Admin/Clerk ICU | $4,707 | | $4,707 | 1 | 94% | Protocol-A | $495 | $115 | $110 | $115 | $363 | $231 | $2,177 | $363 | $121 | $137 | $198 |
| Supplies ICU | $16,292 | $16,292 | $0 | 1 | 100% | ICUAcuity | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Nursing Ward 3A | $85,055 | | $85,055 | 1 | 32% | Protocol-N | $2,074 | $642 | $258 | $900 | $5,470 | $1,205 | $10,424 | $3,592 | $681 | $172 | $1,800 |
| Paraprof'l Ward 3A | $56,292 | | $56,292 | 1 | 32% | Protocol-N | $1,373 | $425 | $171 | $596 | $3,620 | $798 | $6,899 | $2,377 | $451 | $114 | $1,191 |
| Admin/Clerk Ward 3A | $3,886 | | $3,886 | 1 | 32% | Protocol-A | $139 | $32 | $31 | $32 | $102 | $65 | $612 | $102 | $34 | $39 | $56 |
| Supplies Ward 3A | $51,194 | $51,194 | $0 | 1 | 100% | Protocol-N | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Pharmacy | $86,513 | $86,513 | $0 | 1 | 100% | Wtd-procs-P | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Pharmacy Labor | $152,709 | | $152,709 | 1 | 4% | Wtd-procs-P | $424 | $28 | $37 | $25 | $1,091 | $63 | $1,143 | $139 | $16 | $26 | $3,117 |
| Diagnostic Radiology | $4,972 | $4,972 | $0 | 1 | 100% | Wtd-procs-X | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Radiology Labor | $299,689 | | $299,689 | 1 | 4% | Wtd-procs-X | $1,947 | $171 | $148 | $97 | $1,280 | $369 | $4,298 | $341 | $170 | $17 | $3,149 |
| Lab | $26,161 | $12,558 | $13,603 | 1 | 48% | Wtd-procs-L | $608 | $46 | $33 | $44 | $744 | $178 | $2,041 | $322 | $97 | $805 | $1,610 |
| Cath Lab | $14,428 | $14,428 | $0 | 1 | 100% | Wtd-procs-C | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Cath Lab Labor | $45,622 | | $45,622 | 1 | 14% | Wtd-procs-C | $0 | $0 | $0 | $0 | $899 | $1,002 | $3,887 | $0 | $0 | $0 | $599 |
| Resp Ther Supplies | $5,070 | $5,070 | $0 | 1 | 100% | Wtd-procs-R | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Respiratory Ther Labor | $108,871 | | $108,871 | 1 | 6% | Wtd-procs-R | $1,436 | $133 | $174 | $117 | $405 | $224 | $1,262 | $131 | $63 | $65 | $2,521 |
| Total: | $2,275,720 | $343,375 | $1,932,345 | | | | $34,081 | $4,733 | $5,129 | $4,649 | $33,348 | $21,186 | $143,294 | $24,410 | $6,743 | $2,283 | $57,018 |

Table 8: Direct Traceable Costs Recorded Against each Service

# Departmental Direct Costs

**Period: Sept 1994**

| Cost Type | Dept Total | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 358 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brief description:** | | **Major Chest** | **Resp w/cc** | **Resp w/o cc** | **Resp>70cc** | **Valve/Cath** | **Valve/NC** | **Bypass/Cath** | **Bypass/NC** | **Other Card** | **Ret&Im>70** | **Tracheost** |
| Surgeon Labor | | | | | | | | | | | | |
| Perfusion Labor | | | | | | | | | | | | |
| Perfusion Supplies | $48,548 | $0 | $0 | $0 | $0 | $5,529 | $3,606 | $30,826 | $5,165 | $1,732 | $0 | $1,690 |
| Contract (Perf Svcs) | | | | | | | | | | | | |
| OR Nursing/Paraprof'l | | | | | | | | | | | | |
| OR Supplies | $103,800 | $4,000 | $800 | $800 | $800 | $20,700 | $13,800 | $48,600 | $8,100 | $2,700 | $0 | $3,500 |
| Anesthesiology Labor | | | | | | | | | | | | |
| Anesthesiology Supplies | | | | | | | | | | | | |
| Equipment | | | | | | | | | | | | |
| Nursing ICU | | | | | | | | | | | | |
| Paraprof'l ICU | | | | | | | | | | | | |
| Admin/Clerk ICU | | | | | | | | | | | | |
| Supplies ICU | $16,292 | $2,304 | $192 | $128 | $128 | $770 | $1,320 | $8,533 | $483 | $322 | $0 | $2,112 |
| Nursing Ward 3A | | | | | | | | | | | | |
| Paraprof'l Ward 3A | | | | | | | | | | | | |
| Admin/Clerk Ward 3A | | | | | | | | | | | | |
| Supplies Ward 3A | $51,194 | $4,435 | $1,858 | $579 | $999 | $7,608 | $1,039 | $18,424 | $2,310 | $445 | $299 | $13,198 |
| Pharmacy | $86,513 | $9,479 | $1,126 | $391 | $667 | $12,437 | $1,456 | $18,313 | $2,737 | $110 | $144 | $39,653 |
| Pharmacy Labor | | | | | | | | | | | | |
| Diagnostic Radiology | $4,972 | $837 | $253 | $69 | $18 | $686 | $52 | $2,757 | $36 | $28 | $1 | $235 |
| Radiology Labor | | | | | | | | | | | | |
| Lab | $12,558 | $1,402 | $154 | $60 | $74 | $1,481 | $326 | $3,868 | $593 | $173 | $0 | $4,427 |
| Cath Lab | $14,428 | | | | | $879 | $6,521 | $6,442 | | | | $586 |
| Cath Lab Labc | | | | | | | | | | | | |
| Resp Ther Supplies | $5,070 | $746 | $251 | $185 | $176 | $647 | $61 | $805 | $35 | $104 | $62 | $1,998 |
| Respiratory Ther Labor | | | | | | | | | | | | |
| **Total:** | $343,375 | $23,203 | $4,634 | $2,212 | $2,862 | $50,737 | $28,181 | $138,568 | $19,459 | $5,614 | $506 | $67,399 |

Table 9: Cost Drivers and Allocation Bases Used to Fairly Assign Costs

## Cost Driver Statistics per Procedure

**Period: Sept 1994**

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Brief Description | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| DRG-wts | DRG weights from CHAMPUS | 234.86 | 3.1426 | 2.4449 | 1.2865 | 0.9965 | 8.9205 | 6.3721 | 6.2021 | 5.1445 | 5.13 | 1.3753 | 20.6684 |
| ICUAcuity | ICU Acuity (Nursing Care Hours) | 3549 | 65 | 45 | 18 | 45 | 57 | 146 | 67 | 67 | 64 | 0 | 591 |
| Protocol-A | Protocol minutes/admin or clerk | 805 | 18 | 21 | 20 | 21 | 22 | 21 | 22 | 22 | 22 | 25 | 18 |
| Protocol-B | Protocol minutes/anesthesia | 10928 | 293 | 176 | 315 | 132 | 342 | 325 | 298 | 254 | 228 | 78 | 366 |
| Protocol-C | Protocol minutes/clinician | 10928 | 293 | 176 | 315 | 132 | 342 | 325 | 298 | 254 | 228 | 78 | 366 |
| Protocol-N | Protocol Nursing Care Hours/nurse/tech | 3478 | 53 | 82 | 33 | 115 | 233 | 77 | 74 | 153 | 87 | 22 | 115 |
| Protocol-O | Protocol minutes/OR nurse/tech | 9242 | 222 | 95 | 261 | 99 | 289 | 282 | 259 | 230 | 183 | 63 | 324 |
| Protocol-P | Protocol minutes/perfusionist | 46486 | 0 | 0 | 0 | 0 | 1696 | 1451 | 1540 | 1606 | 1376 | 0 | 2291 |
| Wtd-procs-C | Cath Lab | 2481.4 | 0 | 0 | 0 | 0 | 116.4 | 194.6 | 83.9 | 0 | 0 | 0 | 116.4 |
| Wtd-procs-L | Laboratory tests | 53492.51 | 995.54 | 375.55 | 273.7 | 361.3 | 2031.56 | 730.7 | 929.11 | 880.2 | 798.6 | 6595 | 6595 |
| Wtd-procs-P | Pharmaceuticals | 10498.02 | 145.72 | 48.03 | 63.6 | 42.7 | 625 | 54.33 | 109.11 | 79.4 | 27.35 | 44.8 | 2678.55 |
| Wtd-procs-R | Standard resp therapies | 683.97 | 30.08 | 13.92 | 18.27 | 12.2 | 14.14 | 11.75 | 7.34 | 4.58 | 6.62 | 6.78 | 132 |
| Wtd-procs-X | Radiology films | 6014 | 195.36 | 86 | 74 | 48.6 | 214.1 | 92.6 | 119.8 | 57.1 | 85.2 | 8.4 | 789.9 |

Table 10: Quantity of Services Provided by each Clinician

## Physician Case Workload

**Period: Sept 1994**

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name:** | | | **Major Chest** | **Resp w/cc** | **Resp w/o cc** | **Resp>70cc** | **Valve/Cath** | **Valve/NC** | **Bypass/Cath** | **Bypass/NC** | **Other Card** | **Ret&Im>70** | **Tracheost** |
| **Quantity Provided during the period:** | | 38 | 5 | 2 | 1 | 1 | 3 | 2 | 18 | 2 | 1 | 1 | 2 |
| Myers | Dr John | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Crooke | Dr Greg | | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 2 | 1 | 0 | 1 | 1 | 0 | 7 | 2 | 0 | 1 | 2 |
| Stahl | Dr Rich | | 3 | 1 | 1 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 0 |

Table 11: Laboratory Testing Ordered by each Physician, for each Service

# Physician Laboratory Testing      Period: Sept 1994

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 358 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | | | **Major Chest** | **Resp w/cc** | **Resp w/o cc** | **Resp>70cc** | **Valve/Cath** | **Valve/NC** | **Bypass/Cath** | **Bypass/NC** | **Other Card** | **Ret&Im>70** | **Tracheost** |
| **Aggregate** | | 46392.9 | 4977.7 | 751.1 | 273.7 | 361.3 | 6094.7 | 1461.4 | 16724 | 1760.4 | 798.6 | 0 | 13190 |
| Myers | Dr John | | 0 | 0 | 0 | 0 | 0 | 0 | 1046.8 | 0 | 798.6 | 0 | 0 |
| Crooke | Dr Greg | | 0 | 0 | 0 | 0 | 2321.5 | 1461.4 | 558.7 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 898.1 | 295 | 0 | 361.3 | 3199 | 0 | 7052.7 | 1760.4 | 0 | 0 | 13190 |
| Stahl | Dr Rich | | 4079.6 | 456.1 | 273.7 | 0 | 574.2 | 0 | 8065.8 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | 995.54 | 375.55 | 273.70 | 361.30 | 2031.57 | 730.70 | 929.11 | 880.20 | 798.60 | 0.00 | 6595.00 |
| Myers | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1046.80 | 0.00 | 798.60 | 0.00 | 0.00 |
| Crooke | Dr Greg | | 0.00 | 0.00 | 0.00 | 0.00 | 2321.50 | 730.70 | 558.70 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | 449.05 | 295.00 | 0.00 | 361.30 | 3199.00 | 0.00 | 1007.53 | 880.20 | 0.00 | 0.00 | 6595.00 |
| Stahl | Dr Rich | | 1359.87 | 456.10 | 273.70 | 0.00 | 574.20 | 0.00 | 896.20 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 12: Operating Room Time by Physician, for each Service

# OR Time by Physician

**Period: Sept 1994**

| Product List: | | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | | | | **Major Chest** | **Resp w/cc** | **Resp w/o cc** | **Resp>70cc** | **Valve/Cath** | **Valve/NC** | **Bypass/Cath** | **Bypass/NC** | **Other Card** | **Ret&Im>70** | **Tracheost** |
| **Aggregate** | | | 9268 | 1108 | 189 | 261 | 99 | 867 | 564 | 4827 | 459 | 183 | 63 | 648 |
| Myers | Dr John | | 324 | 0 | 0 | 0 | 0 | 0 | 0 | 141 | 0 | 183 | 0 | 0 |
| Crooke | Dr Greg | | 1359 | 0 | 0 | 0 | 0 | 420 | 564 | 375 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 3466 | 369 | 81 | 0 | 99 | 222 | 0 | 1525 | 459 | 0 | 63 | 648 |
| Stahl | Dr Rich | | 4119 | 739 | 108 | 261 | 0 | 225 | 0 | 2786 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | | 221.60 | 94.50 | 261.00 | 99.00 | 289.00 | 282.00 | 268.17 | 229.50 | 183.00 | 63.00 | 324.00 |
| Myers | Dr John | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 141.00 | 0.00 | 183.00 | 0.00 | 0.00 |
| Crooke | Dr Greg | | | 0.00 | 0.00 | 0.00 | 0.00 | 420.00 | 282.00 | 375.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | | 184.50 | 81.00 | 0.00 | 99.00 | 222.00 | 0.00 | 217.86 | 229.50 | 0.00 | 63.00 | 324.00 |
| Stahl | Dr Rich | | | 246.33 | 108.00 | 261.00 | 0.00 | 225.00 | 0.00 | 309.56 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 13: Radiology Orders by Physician, for each Service

## Physician Radiology Orders

**Period: Sept 1994**

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 389 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| **Aggregate** | | 6156 | 976.8 | 171 | 74 | 48.6 | 642.3 | 185.2 | 2270.5 | 114.2 | 85.2 | 8.4 | 1579.8 |
| Myers | Dr John | 175.2 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 0 | 85.2 | 0 | 0 |
| Crooke | Dr Greg | 341.2 | 0 | 0 | 0 | 0 | 108 | 185.2 | 48 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | 3462.4 | 161.6 | 68 | 0 | 48.6 | 497.1 | 0 | 984.7 | 114.2 | 0 | 8.4 | 1579.8 |
| Stahl | Dr Rich | 2177.2 | 815.2 | 103 | 74 | 0 | 37.2 | 0 | 1147.8 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | 195.36 | 85.50 | 74.00 | 48.60 | 214.10 | 92.60 | 126.14 | 57.10 | 85.20 | 8.40 | 789.90 |
| Myers | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 90.00 | 0.00 | 85.20 | 0.00 | 0.00 |
| Crooke | Dr Greg | | 0.00 | 0.00 | 0.00 | 0.00 | 108.00 | 92.60 | 48.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | 80.80 | 68.00 | 0.00 | 48.60 | 497.10 | 0.00 | 140.67 | 57.10 | 0.00 | 8.40 | 789.90 |
| Stahl | Dr Rich | | 271.73 | 103.00 | 74.00 | 0.00 | 37.20 | 0.00 | 127.53 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 14: Anesthesiology Time by each Physician, for each Service

# Anesthesiology Time by Physician (MOS) Period: Sept 1994

| Product List: | | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| **Aggregate** | | | 11058.2 | 1464 | 352.2 | 315 | 132 | 1026 | 650 | 5575 | 507 | 228 | 78 | 731 |
| Myers | Dr John | | 411 | 0 | 0 | 0 | 0 | 0 | 0 | 183 | 0 | 228 | 0 | 0 |
| Crooke | Dr Greg | | 1568 | 0 | 0 | 0 | 0 | 489 | 650 | 429 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 4301 | 561 | 180 | 0 | 132 | 261 | 0 | 1851 | 507 | 0 | 78 | 731 |
| Stahl | Dr Rich | | 4778.2 | 903 | 172.2 | 315 | 0 | 276 | 0 | 3112 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | | 292.80 | 176.10 | 315.00 | 132.00 | 342.00 | 325.00 | 309.72 | 253.50 | 228.00 | 78.00 | 365.50 |
| Myers | Dr John | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 183.00 | 0.00 | 228.00 | 0.00 | 0.00 |
| Crooke | Dr Greg | | | 0.00 | 0.00 | 0.00 | 0.00 | 489.00 | 325.00 | 429.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | | 280.50 | 180.00 | 0.00 | 132.00 | 261.00 | 0.00 | 264.43 | 253.50 | 0.00 | 78.00 | 365.50 |
| Stahl | Dr Rich | | | 301.00 | 172.20 | 315.00 | 0.00 | 276.00 | 0.00 | 345.78 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 15: Respiratory Therapy Orders, by each Physician, for each Service

## Respiratory Therapy by Physician (WP) Period: Sept 1994

| Product List: | | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| **Aggregate** | | | 642.67 | 120.35 | 27.83 | 18.27 | 12.2 | 29.56 | 23.51 | 124.87 | 9.17 | 6.62 | 6.28 | 264.01 |
| Myers | Dr John | | 21.79 | 0 | 0 | 0 | 0 | 0 | 0 | 15.17 | 0 | 6.62 | 0 | 0 |
| Crooke | Dr Greg | | 39.56 | 0 | 0 | 0 | 0 | 13.25 | 23.51 | 2.8 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 356.23 | 11.45 | 13.46 | 0 | 12.2 | 13.25 | 0 | 26.41 | 9.17 | 0 | 6.28 | 264.01 |
| Stahl | Dr Rich | | 225.09 | 108.9 | 14.37 | 18.27 | 0 | 3.06 | 0 | 80.49 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | | 24.07 | 13.92 | 18.27 | 12.20 | 9.85 | 11.76 | 6.94 | 4.59 | 6.62 | 6.28 | 132.01 |
| Myers | Dr John | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.17 | 0.00 | 6.62 | 0.00 | 0.00 |
| Crooke | Dr Greg | | | 0.00 | 0.00 | 0.00 | 0.00 | 13.25 | 11.76 | 2.80 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | | 5.73 | 13.46 | 0.00 | 12.20 | 13.25 | 0.00 | 3.77 | 4.59 | 0.00 | 6.28 | 132.01 |
| Stahl | Dr Rich | | | 36.30 | 14.37 | 18.27 | 0.00 | 3.06 | 0.00 | 8.94 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 16: Perfusion Minutes of Service, by each Physician, for each Service

## Perfusion Time

## Period: Sept 1994

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&lm>70 | Tracheost |
| **Aggregate** | | 44198 | 0 | 0 | 0 | 0 | 5088 | 2902 | 27723 | 4818 | 1376 | 0 | 2291 |
| Myers | Dr John | 2632 | 0 | 0 | 0 | 0 | 0 | 0 | 1256 | 0 | 1376 | 0 | 0 |
| Crooke | Dr Greg | 6749 | 0 | 0 | 0 | 0 | 2126 | 2902 | 1721 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | 19107 | 0 | 0 | 0 | 0 | 1496 | 0 | 10502 | 4818 | 0 | 0 | 2291 |
| Stahl | Dr Rich | 15710 | 0 | 0 | 0 | 0 | 1466 | 0 | 14244 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | 0.00 | 0.00 | 0.00 | 0.00 | 1696.00 | 1451.00 | 1540.17 | 2409.00 | 1376.00 | 0.00 | 1145.50 |
| Myers | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1256.00 | 0.00 | 1376.00 | 0.00 | 0.00 |
| Crooke | Dr Greg | | 0.00 | 0.00 | 0.00 | 0.00 | 2126.00 | 1451.00 | 1721.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 1496.00 | 0.00 | 1500.29 | 2409.00 | 0.00 | 0.00 | 1145.50 |
| Stahl | Dr Rich | | 0.00 | 0.00 | 0.00 | 0.00 | 1466.00 | 0.00 | 1582.67 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 17: Cath Lab Orders by Physician, for each Service

## Cath Lab Orders (WP) by Physician     Period: Sept 1994

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| **Aggregate** | | 2119 | 0 | 0 | 0 | 0 | 349.2 | 194.6 | 1342.4 | 0 | 0 | 0 | 232.8 |
| Myers | Dr John | 153.4 | 0 | 0 | 0 | 0 | 0 | 0 | 153.4 | 0 | 0 | 0 | 0 |
| Crooke | Dr Greg | 358.5 | 0 | 0 | 0 | 0 | 116.4 | 194.6 | 47.5 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | 750.6 | 0 | 0 | 0 | 0 | 116.4 | 0 | 401.4 | 0 | 0 | 0 | 232.8 |
| Stahl | Dr Rich | 856.5 | 0 | 0 | 0 | 0 | 116.4 | 0 | 740.1 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | 0.00 | 0.00 | 0.00 | 0.00 | 116.40 | 97.30 | 74.58 | 0.00 | 0.00 | 0.00 | 116.40 |
| Myers | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 153.40 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crooke | Dr Greg | | 0.00 | 0.00 | 0.00 | 0.00 | 116.40 | 97.30 | 47.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 116.40 | 0.00 | 57.34 | 0.00 | 0.00 | 0.00 | 116.40 |
| Stahl | Dr Rich | | 0.00 | 0.00 | 0.00 | 0.00 | 116.40 | 0.00 | 82.23 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 18: ICU Hours of Service by Physician, for each Service

# ICU (HOS) by Physician

**Period: Sept 1994**

| Product List: | | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | | | | **Major Chest** | **Resp w/cc** | **Resp w/o cc** | **Resp>70cc** | **Valve/Cath** | **Valve/NC** | **Bypass/Cath** | **Bypass/NC** | **Other Card** | **Ret&Im>70** | **Tracheost** |
| **Aggregate** | | | 2939.48 | 609.5 | 122.66 | 24.25 | 24.25 | 105.5 | 263.83 | 773.91 | 55 | 24.58 | 0 | 936 |
| Myers | Dr John | | 90.33 | 0 | 0 | 0 | 0 | 0 | 0 | 65.75 | 0 | 24.58 | 0 | 0 |
| Crooke | Dr Greg | | 308.99 | 0 | 0 | 0 | 0 | 30 | 263.83 | 15.16 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | | 2034.66 | 540 | 98.41 | 0 | 24.25 | 49 | 0 | 332 | 55 | 0 | 0 | 936 |
| Stahl | Dr Rich | | 505.5 | 69.5 | 24.25 | 24.25 | 0 | 26.5 | 0 | 361 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| **Per Case** | **Average** | Comparison to mean | | 121.90 | 61.33 | 24.25 | 24.25 | 35.17 | 131.92 | 43.00 | 27.50 | 24.58 | 0.00 | 468.00 |
| Myers | Dr John | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 65.75 | 0.00 | 24.58 | 0.00 | 0.00 |
| Crooke | Dr Greg | | | 0.00 | 0.00 | 0.00 | 0.00 | 30.00 | 131.92 | 15.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | | 270.00 | 98.41 | 0.00 | 24.25 | 49.00 | 0.00 | 47.43 | 27.50 | 0.00 | 0.00 | 468.00 |
| Stahl | Dr Rich | | | 23.17 | 24.25 | 24.25 | 0.00 | 26.50 | 0.00 | 40.11 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 19: Pharmacy Orders by Physician, for each Service

# Pharmacy Orders (WP) by Physician     Period: Sept 1994

| Product List: | | Total Basis | 75 | 76 | 77 | 101 | 104 | 105 | 106 | 107 | 108 | 398 | 483 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | Major Chest | Resp w/cc | Resp w/o cc | Resp>70cc | Valve/Cath | Valve/NC | Bypass/Cath | Bypass/NC | Other Card | Ret&Im>70 | Tracheost |
| Aggregate | | 10466.1 | 728.6 | 96.05 | 63.6 | 42.7 | 1874.9 | 108.65 | 1884.15 | 238.2 | 27.35 | 44.8 | 5357.1 |
| Myers | Dr John | 354.8 | 0 | 0 | 0 | 0 | 0 | 0 | 327.45 | 0 | 27.35 | 0 | 0 |
| Crooke | Dr Greg | 366.35 | 0 | 0 | 0 | 0 | 245.55 | 108.65 | 12.15 | 0 | 0 | 0 | 0 |
| Rhee | Dr John | 8242.55 | 88.5 | 65 | 0 | 42.7 | 1578 | 0 | 828.25 | 238.2 | 0 | 44.8 | 5357.1 |
| Stahl | Dr Rich | 1502.4 | 640.1 | 31.05 | 63.6 | 0 | 51.35 | 0 | 716.3 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| Per Case | Average | Comparison to mean | 145.72 | 48.03 | 63.60 | 42.70 | 624.97 | 54.33 | 104.68 | 119.10 | 27.35 | 44.80 | 2678.55 |
| Myers | Dr John | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 327.45 | 0.00 | 27.35 | 0.00 | 0.00 |
| Crooke | Dr Greg | | 0.00 | 0.00 | 0.00 | 0.00 | 245.55 | 54.33 | 12.15 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhee | Dr John | | 44.25 | 65.00 | 0.00 | 42.70 | 1578.00 | 0.00 | 118.32 | 119.10 | 0.00 | 44.80 | 2678.55 |
| Stahl | Dr Rich | | 213.37 | 31.05 | 63.60 | 0.00 | 51.35 | 0.00 | 79.59 | 0.00 | 0.00 | 0.00 | 0.00 |

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